



# Data Storage

**Susan:** Hello and welcome to Tech Talk from the University of Minnesota, your source for information about the technology that surrounds us every day. I'm your host, Susan McKinnell. Data storage; isn't this a topic for big businesses? Actually everything your computer does, from sending emails to playing a collection of music couldn't happen without a place to keep that data. So that's what we're going to talk about today. What are your options for storing digital files? How stable are the various media? And how can you be sure you won't lose your data? Some of the terms you'll hear include: flash drive, solid state and intelligent storage. With us today is Alexander St. Croix. Alex graduated in 2003 from the University of Minnesota. His degree in English has an emphasis on writing poetry. He now works for the University as a technology help line and training consultant. Alex also conducts independent research and development in enterprise Java system architectures and open source software. Thank you for being here today, Alex.

Alex: No problem, thank you.

**Susan:** Now we have a lot of fun things here today. I want to start off with knowing, though, the difference between this guy here, a CD, and this one, a DVD.

Alex: Well, the primary difference between a CD and a DVD is the size. This one here, the CD, is 700 megabytes. And this one over here is actually 4.7 gigabytes. That is more than 5 times, 6 times larger.

**Susan:** So, really other than the fact that they're a different size they're really basically the same type of thing.

Alex: Well, it's different technology to read it.

**Susan:** Okay.

Alex: And to write it. It's totally different. You can put a lot more content on here (points to the DVD) which is why DVDs come with movies on them.

**Susan:** Okay.

Alex: You can have very high quality graphics and sound. A CD is more limited in the amount of data that it can hold.

**Susan:** You just can't put as much on it. These both look very similar. These are both writable.

Alex: That's right.

**Susan: You can write to it, as opposed to, I've got some audio CDs at home that, obviously, I bought them in the music store. I wouldn't be able to record anything on there.**

Alex: No; those are locked.

**Susan: Mm. Hmm. But I could use these, you know, I could put music on here or a movie on the DVD.**

Alex: That's right.

**Susan: But what else could I put on here.**

Alex: Well, you could put data from your computer on it. You could put files, papers, photographs, anything that you could store on your computer, basically, you could write on one of these too.

**Susan: So, that's the main point, is that we can store any computer files on here. Just like we could on a floppy way back when and now we can put them on CDs, DVDs. What are some of these other things I've got here?**

Alex: Well, these...

**Susan: You want to go with these next?**

Alex: ...are actually...these are called memory sticks. Sometimes they're called like Flash drives or jump drives. And these are the same as these. You can store data on them only the beautiful part about it is that inside of these things there are actually no moving parts. Everything is solid state and so they don't get...you don't have to worry about bumping them or shaking them or them getting disturbed when they are being used. That makes them very useful for storing data on, for example, the same memory inside of here is the same memory that is inside of an mp3 player or inside of a digital camera.

**Susan: Okay.**

Alex: And so it'd much more secure and protected because it's not moving around so it's not going to get scratched or skip like a record or a CD would

**Susan: Yeah. And when I take a CD out; a musical CD player, sometimes you get that skipping when you're walking along, that kind of thing.**

Alex: Exactly.

**Susan: Bump the machine, you get the skipping. You're not going to have that with this.**

Alex: You're not going to have any trouble with that.

**Susan: I would think that this would last longer too, possibly.**

Alex: One would think.

**Susan: Now, how much is this going to hold here, it says 256 megabytes.**

Alex: That's 256 megs so it's a little bit over a third of the CD but there is one here, actually these two both have 512 megs and you can get these in a gigabyte size that's even larger than the disk.

**Susan: Now these are very common these days. How easy is it to use them?**

Alex: You literally just plug them into your computer and they just work.

**Susan: Okay, I still see CDs all over the place, though. Why would you buy a CD when you could use this if you don't have the issues with moving parts and so forth?**

Alex: Well, the nice thing about CDs is that they are very inexpensive. You can buy CDs for almost nothing nowadays and they're great if you just want to record something onto them and put it up on a shelf and keep it.

**Susan: So great for backing things up?**

Alex: Yes, archiving—things like that.

**Susan: Very important issue. This is of course one of the main reasons why you'd have anything to store on besides your main computer.**

Alex: Anything worth having is worth having a copy of.

**Susan: Absolutely, sounds very good. And I suppose the other thing with the CD is that you could send it off to someone else too.**

Alex: That's exactly right.

**Susan: Very inexpensive. What do I have right here? What's this thing?**

Alex: This is actually a 512 meg memory card which is the same size as one of these.

**Susan: Same as the flash drive or jump drive.**

Alex: Exactly, you're going to find those in digital cameras. Those are the little card that you slide into your digital camera and pull it back out.

**Susan: There are lots of different kinds of these, aren't there? There are slightly different shapes and so forth.**

Alex: Yes. All sorts of shapes and sizes but that's a pretty common one nowadays.

**Susan: I can't just plug this into my computer, though.**

Alex: No you can't, actually. There is a special type of adapter that you need to get in order to do that.

**Susan: Mm Hmm. That guy right here, right?**

Alex: That's right.

**Susan: And this guy...every time we see this kind of connector; what is this kind of connector is this I have here?**

Alex: It's called a USB connector which means Universal Service Bus.

**Susan: Universal. That really pretty universal these days, right?**

Alex: It really is universal.

**Susan: A new computer is definitely going to have one of those.**

Alex: Absolutely.

**Susan: And so this guy is going to fit right in there.**

Alex: Yep.

**Susan: That reminds me of an old fashioned floppy.**

Alex: It does only it's a lot smaller and there are no moving parts.

**Susan: Absolutely.**

Alex: If you took one of those old floppies and pulled it apart you could actually see inside there is a little shiny disk and you'd put it into the computer. These don't have any moving parts, which allows them to be smaller but it also prevents them from getting damaged as much. Those floppies were...they had a glass jaw.

**Susan: It's a little dangerous to keep your stuff on there. Luckily we have newer things to work with. Okay, now what do have over here? This guy right here...**

Alex: That is what's called a hard drive. Now, this is something that is inside of your computer. The hard drive is what basically everybody's computer has inside of it.

**Susan: Mm. Hmm.**

Alex: And it's just like a floppy or a disk drive but it has a much higher capacity but it's still, if you look in there there's a shiny disk and when you use this thing you're computer's on, the disk is spinning around very fast and this little lever here is moving around and gathering data, writing it and reading it off.

**Susan: The same way it does a CD, same way the DVD. This is in my computer, it's in everybody's computer right now and they are called hard disks sometimes because they are actually a disk.**

Alex: Exactly.

**Susan: I just opened this guy up but I just want to mention that we would recommend anyone doing with their own computer. I couldn't go an use this at this point could I?**

Alex: You might be able to put it back together and put it on your computer but if you got any dust on there or any grit or anything like that you could bet that it is probably going to not work anymore.

**Susan: So, the main difference between this and what we've been looking at so far is that your hard drive isn't, your own hard drive for your computer is not portable storage.**

Alex: No, I wouldn't call it that at all. It is something that is bolted in and it's not supposed to ever move. And this can be a problem, for example, with laptops. A lot of times laptops, nowadays, the vendors are starting to look at putting hard drives in that are based on this type of technology where there is no moving part. And you'll see commercials where somebody drops their laptop and its got that special technology to keep it from scratching. So what that does is it can tell when the computer is falling and it stops moving the disk so if it crashes or hits the ground or something it doesn't scratch it just like a record.

**Susan: Just like the record. If you scratch the record you obviously don't want to listen to that scratch for ever and ever. But if you scratch a hard disk you might ruin it entirely.**

Alex: Right.

**Susan: Definitely lose the data that on there.**

Alex: Yep.

**Susan: So you say that laptops are moving in the direction that's not moving something more similar technology-wise to something like jump drives and flash drives.**

Alex: Exactly.

**Susan: What have you got over here?**

Alex: Well, you'll see here, this is actually a Dell MP3 player and these are sort of the forerunners and prototypes for what's coming down the line in terms of that technology where you have a hard drive that's based on this flash memory inside of a computing device.

**Susan: Now this is similar, it's an mp3 player so there are iPods out there, many other different brands.**

Alex: Yeah.

**Susan: Absolutely. And how much can this hold? How much data can you put on this guy?**

Alex: That, actually, can hold 20 gigabytes which is ah...

**Susan: I've got a computer at home that can hold that much on the hard drive so....**

Alex: Yeah, exactly so it's quite a lot. It's forty of these.

**Susan: Absolutely. So it's getting bigger and bigger. More and more data on a smaller and smaller thing. That's the direction we keep on going in.**

Alex: Yeah, all the time.

**Susan: Absolutely. So now, this is an mp3 player. You're saying I could just store files on here if I want to.**

Alex: Sure.

**Susan: So I can use it kind of as an external hard drive, kind of like a flash drive.**

Alex: Yep. A lot of them can do that. You just have to check. It's different from brand to brand. All the different types have different requirements and abilities and things like that.

**Susan: So certainly if I just go out and buy an mp3 player I want to check into it and make sure I can store other files on it as well. I can't just assume that that's the way I can use it.**

Alex: Right. Shop around a little bit.

**Susan: It's always a good idea. There's lots of different prices for these things out there. What is this guy right here?**

Alex: That's actually another type of hard drive.

**Susan: This little disk is a hard drive.**

Alex: It's just like this. I know it's the size of a hockey puck. But actually if you turn you see, and pull this out, that's...

**Susan: There is the USB connector right there.**

Alex: That's the USB connector. You can plug that right into the back of your computer and you've got an external 5gig hard drive.

**Susan: Five gigabytes.**

Alex: And you can take that with you on the road.

**Susan: Bigger than a DVD, fabulous. It fits in a pocket. This, again, is using the same technology as the jump drive.**

Alex: Mm. Hmm.

**Susan: So one of the big things too, is that you can take information on and off of them repeatedly.**

Alex: That's right.

**Susan: The CD, you can rewritable CDs but typically you don't want to rewrite on them too frequently.**

Alex: Well, if that's your only backup, you're sort of out on a limb.

**Susan: For backup, you'd want to use a regular CD.**

Alex: Yep.

**Susan: Okay, good to hear. By the way, speaking of backing up you get all your data on stuff, I know it's very important not to let that data get into anyone else's hands. We don't have a whole lot of time but I want to make sure that once I am done with my computer someone is not going to get my info off my hard drive.**

Alex: That's very important and there are programs that you can either buy or get off of the internet and there are many out there if you shop around or look around that will actually run on a CD ROM. Put the in, start your computer up, follow the instructions and it will actually go through and wipe your hard drive off many many times.

**Susan: Fabulous. I can get that at any computer supply store?**

Alex: you should be able to, yes.

**Susan: or check for it on the web too. What if I've got my backup on something like this? What do I do with this?**

Alex: With this you put it in a little case, put it up in a book shelf and just don't mess around with it. Don't scratch it.

**Susan: But when I'm all done?**

Alex: When you're all done...

**Susan: I'm not going to throw this in the trash, right?**

Alex: Well, if you don't mind I could actually show you what you could do.

**Susan: Great.**

Alex: If you wanted to take and make sure that nobody was going to get your data off of it, you could just take a pen, okay, and take the paint here and just scratch that paint and it'll come right off. And that is where all the data is kept. It's on the back of that paint.

**Susan: Fabulous.**

Alex: So if you just take that and scratch it up really good.

**Susan: Nobody else is going to get my data from that. That's for sure.**

Alex: Nobody will do it. And if you look, now, on here you can see the scratches.

**Susan: Thank you so much for being here with us today Alex. You've given us lots of great information.**

Alex: Thank you for having me.

**Susan: So there are many storage options that are available. But, how well do the different options work and how long will they last? Here to help us answer these questions is Professor David Du. David is a professor of computer science and engineering here at the University of Minnesota. He is an IEEE fellow and a fellow of the Minnesota Super Computer institute. Among other things he has research multimedia computing, high-speed networking and mass storage systems.**

David: I'm really happy to be here.

**Susan: Great! Thank you for being here. We were just talking with Alex about a lot of different ways to back up out data. Why is it important to put something off of our hard drive and onto other storage devices?**

David: I think the most valuable thing is the data itself. So, the hard drive or the storage device are just keeping it. And any storage device can fail or be potentially lost. So you need to keep multiple copies in different locations from time to time.

**Susan: So the importance is to make sure there are multiple copies not necessarily just two, maybe even more depending on the value of the data?**

David: Yes and also depending on the location of the where you back up your data.

**Susan: So you say that any location so maybe not just right next to my computer. I suppose if you have, you know, your personal computer at home, if you have a house fire that may be a real big issue.**

David: Certainly. For business, in some sense, you need to backup 500 miles away. Because if you have an earthquake or something like that really needs to be a concern.

**Susan: Any sort of natural disaster; that makes a lot of sense. What about the drives themselves? I mean does my hard drive on my computer ever decay?**

David: We have basically two types of hard drive, one called the ATA drive, used on the personal computer. For business use we have skuzzy drives. The ATA drive is more or less under warrantee for three years.

**Susan: Three years. How often does an ATA drive fail after three years?**

David: There is a very good possibility after three years, even before three years your hard drive can fail. You know, it can fail in the first year.

**Susan: And I know a lot of us, of course, have computers that we may have had for more than three years. So is this something that we are running a real risk of if we keep on using that hard drive?**

David: In fact, a skuzzy drive you are supposed to run 24/7.

**Susan: You are supposed to run...so for businesses you are supposed to run skuzzy drive all the time?**

David: All the time.

**Susan: so they never turn their computer off.**

David: An ATA drive will be stopped when you turn your computer off, your personal computer.

**Susan: Mm. Hmm. Is that the best way to use it, that I turn off my computer every so often?**

David: More or less. They really look at, if this needs to be 24/7 they put in stronger features into the hard drive to make sure it can last longer.

**Susan: I know a lot of people who doactually do leave their computers on all the time and they are their personal home computers. And I guess I never heard what the final analysis is on what is the best way to use my personal home computer. It sounds like what you're saying is the best thing is to turn it off when I'm done.**

David: Not necessarily. It really depends on the type of drive you're using.

**Susan: Okay. If I have one that's geared toward personal use like an ATA drive then that probably is the best.**

David: Yes. They design that for normal use.

**Susan: Normal use; turning it off when I'm done, turning it back on in the morning. That's certainly not going to wear it out any faster than leaving it on all the time.**

David: No. No.

**Susan: Okay, sounds good. But you're saying that a hard drive might only last three years. I have a lot of information that I want to keep a lot longer than three years. Is the best thing, then, to back it up to a CD, a DVD or something like that?**

David: I think that's the least you should do.

**Susan: Okay, the least I should do. What about how long is my CD going to be useful?**

David: Your CD can be sitting there for a very long time.

**Susan: Mm. Hmm.**

David: The thing that you worry about more is the device that reads the CD may become obsolete over time.

**Susan: So, just like we don't use 8 track tapes anymore and really you might even find a tape but you'd be hard pressed to find a player. It's the same kind of thing with my CD or my DVD?**

David: Yes, yeah.

**Susan: So, How can I take care of that? What is the best way to deal with that?**

David: This is really the hard question. We have to go from one generation of device to another generation of device and how do you keep your valuable data for more than 30-40 years, or even longer? How do you keep them archived?

**Susan: Absolutely.**

David: That is really the challenging part and quite often people are still using tape libraries for that purpose. A tape library lasts probably twice as long in terms of devices.

**Susan: So tape is something that we haven't even looked at today, but it's putting the information on a tape. It's kind of similar to a VCR tape type of thing isn't it?**

David: Yes and they also have to go through a number of generations as the capacity gets bigger and bigger.

**Susan: Okay, that's lasting longer and longer. For personal use, I, as an individual just need to evaluate every few years how useful my data is.**

David: Right. Exactly.

**Susan: Marvelous! What are the latest things going on with storage right now?**

David: In general, there are a couple of things. One is the capacity really gets bigger and bigger.

**Susan: Absolutely.**

David: In fact, the IO speed, that means how fast you read out the data from the disk drive, is not matching the capacity.

**Susan: Oh!**

David: So that is one of the interesting points.

**Susan: So you can fit lots and lots of data in but it's going to take a little while to get it off of the disk.**

David: The other thing is we have lots of data available to us at our fingertips today. You can go out to the internet and access huge amounts of data.

**Susan: I wanted to ask you real quick, though, a couple things, is I've heard about a micro drive. Can you tell me a little bit about that?**

David: The micro drive is a drive that is less than an inch in terms of size and it holds, today it looks like you can have 8 gigabytes capacity but this gets bigger and bigger. So just like any of the devices that Alex was talking about, pretty much they all have bigger and bigger capacities.

**Susan: Again, smaller and smaller devices with bigger and bigger capacity. What about speaking specifically about DVDs; I've heard about blue laser versus red laser. What's going on in the DVD world?**

David: The blue laser also has bigger capacity coming out and it's supposed to be a newer generation device. On one side we're really happy to see them coming out, the other side is that we clearly have to migrate our data from one device to another.

**Susan: Exactly, whenever the new technology comes out you need to move it along and that's the hard part. It's great to have the new things that fit more but, again, moving along is very difficult. Now you were just saying that we have so much information at our fingertips and of course I have a lot of data on my computer at home but there is so much more data available to us. How are we going to deal with all this?**

David: We really thinking about this in the way the storage devices are fairly dumb today. You can read out a block of data, you can write a block of data to that storage device other than that, most of the information is put into the operating system or other computer software and so on.

**Susan: So, in other words, the storage device itself, the CD, the hard drive, your saying it's dumb.**

David: Yes.

**Susan: It is not a smart device. The way that I'm figuring out where stuff is going is through say Windows or Mac operating system that helps me organize things?**

David: Yes. So the challenge now is we have this huge amount of data and lots of duplication in different devices. How do we manage them becomes a key issue.

**Susan: I have hard time and it's just me personally as opposed to a huge business. I have a hard time finding my data.**

David: So the direction we're going is trying to put more intelligence into the storage device so the storage device can behave like search engine. You know, if you want to discover certain things, the storage device can look for you. You may use a key word or you may use some priority type to get the data you want.

**Susan: Mm. Hmm. And that's going to be working directly with the device instead of having an intermediary operating system.**

David: Exactly and the device can be attached to the internet directly it doesn't have to go through a server and that will really remove a bottleneck that we are facing today. If you access all the data

through a server, the server can be the bottleneck. If you are attached to the network then the client can access that directly.

**Susan: Let me ask for just a little bit of clarification because I think we're talking fairly high-end stuff here. So if I'm accessing data, maybe for my business, on the internet, I have go through a server, a computer that's giving me access to all that data, and you're saying that it's bottlenecking right there at that computer.**

David: Right. So the current connection, this is fairly normal for personal use, your computer has a connection to the network.

**Susan: Absolutely.**

David: And all the data that passes through that network goes through the computer systems on your computer and then your computer has to pass that data to the storage system which is attached to the computer.

**Susan: So there are all these different intermediaries and you're saying we're going to take this storage device and hook it up straight to the network so we don't have that bottleneck going on.**

David: Yes.

**Susan: Fabulous! And this is...what do you call this new type of storage?**

David: We call it intelligent storage. I think it's sort of a new paradigm shift. We're still working on this and we really feel with the enormous amount of data we are facing and how you manage that become a key issue.

**Susan: Sounds like an exciting direction to go in. That you so much for joining us today.**

David: Thank you.

**Susan: Wow! That's a lot of information. Just in case you didn't have time to store all that data yourself, here's a review *for your files*.**

**Susan VO: Alexander St. Croix, a technical specialist at the U of M explained that even though CDs and DVDs may look the same...**

Alex: Well the primary difference between a CD and DVD is the size. This one here, this CD is 700 megabytes and this one over here is actually 4.7 gigabytes. So that's more than 6 times larger.

**Susan VO: Alex showed us some of the smallest and most versatile storage devices around.**

Alex: These are called memory sticks, sometimes they're called flash drives or jump drives. And these are the same as theses (CD/DVDs), You can store data on them only the beautiful part about it is that inside of these things there's actually no moving parts. Everything is solid state and so you don't have to worry about bumping them or shaking them, or them getting disturbed while they're being used.

**Susan VO: Alex warned users to clean any personal data off of a hard drive if it is being sold or**

**given to someone else.**

Alex: And there are programs that you can either buy or get off the internet. There are many out there if you shop around or look around, that will actually run on a CD ROM. Put the CD in, start your computer up, follow the instructions and it will actually go through and wipe your hard drive off many, many times.

**Susan VO: David Du, a professor of computer science and engineering at the U, spoke with us about backing up important files.**

David: I think the most valuable thing is the data itself. So the hard drive or the storage devices are just keeping it. And any of the storage devices can be failed or potentially lost. So you need to keep multiple copies at different locations from time to time.

**Susan VO: Professor Du explained the self life of hard drives and CDs.**

David: We have basically two types of hard drives. One called the ATA drive, used on the personal computer, for business use we have SCSI drives. So the ATA drive is more or less warranted for 3 years there's a very good possibility after 3 years, even before 3 years your hard drive can fail. It can fail in the first year. Your CD can be sitting there for a very long time. The things you worry about is more the device reading that CD -- may become obsolete over time.

**Susan VO: Finally, Professor Du touched on some of the ways researchers are hoping to get more out of storage devices.**

David: The storage device are fairly "dumb" today. You can read out a block of data, you can write a block of data to that storage device. Other than that most of the information are put into our operating system, other than computer software and so on. So the challenge is now, is we have this huge amount of data and lots of duplication at different devices. And how we manage then becomes a key issue. So the direction we are going is trying to put more intelligence into the storage device. So the storage device can behave like a search engine. If you want to discover certain things the storage device can look for you. You may use a key word or you may use some priority type to get the data you want.

**Susan: And don't forget if you have a question about data storage you can post it on our website. The address is [Techtalk.umn.edu](http://Techtalk.umn.edu). Now that you know all about storing your data, you'll be ready for our next show, it's on digital photography, how to get started on taking photos digitally, how to store them and how the technology may be changing the way we record our lives. That's next week on Tech Talk. Thanks for watching, until next time, I'm Susan McKinnell.**

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