Recommendations for Museums
Looking at Future IT Purchases (Spring 2024)

This document was prepared by John Benson, owner of Eaglez Consulting Services, with over 25 years of Information Technology & Communications (IT&C) related experience. I have worked in many facets of the IT&C industry and have also had the benefit of working as part of or in tandem with the Nova Scotian Museum community (and non-profits in general) during that time.

Following are some good basic rules to consider when looking at upgrading and/or replacing your IT equipment. Each section will include a brief explanation and a list of what to look for, what to avoid and why. These are strictly the opinions of Eaglez Consulting Services based on my experience over the years and should not be seen as ANSM endorsing a particular brand or product.

<u>This document covers helpful advice on the following areas:</u>

- Flatbed Scanners
- Portable Handheld Scanners
- Film, Slide & Negative Scanners
- Digital Camcorders
- Smartphone
- Mobile Internet
- Boosting Wi-Fi Signal
- Desktop Computers
- Notebook Computers
- Netbooks, Convertible Notebooks & Tablets
- Data Backup Options
- Discounted Software & Equipment Providers

One little gem I will share in terms of trying to make comparisons between computers and their various parts is the following web site. It compares “apples to apples” in terms of performance between CPUs, video cards, hard drives, systems and mobile devices. The site is: http://www.cpubenchmark.net/

I hope this summary will assist you in your endeavour to go shopping for new equipment, software and services. There are many other things commonly used by museums and I may expand on recommendations for those in a future version of this document. If you have more detailed inquiries on these or any other equipment, please forward them through the ANSM office who will contact me to assist you.

FLATBED SCANNERS

There are a large variety of flatbed scanners out on the market right now. In my experience, the style best-suited for museum applications is a *dedicated flatbed-style scanner*. Those included as part of a multi-function printer or automatic feeder are not recommended whatsoever. Museum conservation standards states that these other style scanners should never be used because they have high potential for damaging fragile documents and/or artefacts.

What to look for:

- If your budget allows, I would recommend trying to source a flatbed scanner that is larger than the standard letter size (8.5" x 11"). You will likely find that many original documents are larger than just letter size and a larger scanning surface will allow you to scan these items in-house, keeping your long-term scanning costs to a minimum. Legal size (8.5" x 14") flatbed scanners are difficult to find, leaving tabloid size (11" x 17") as the only large format option quite often. There is one tabloid size model that is currently available around $900-1000, the Plustek OpticPro A320E (their higher-resolution models generally are $1,200+). Other than that, the next most readily available large format scanners are made by Epson, but they are much higher-resolution and generally cost multiple thousands of dollars.

  Worst case, if you have a fairly limited budget for your scanner purchase, ensure that the letter size scanner you choose offers the flexibility to do as many types of scans as possible. Even a well-featured scanner of this size is usually very well priced and easy to find.

- Many modern flatbed scanners also have the ability to scan either slides and/or negatives which can come in handy, as this can be a costly service if you are not able to do it in-house, so when possible, always try and choose a model which has this feature. Some scanners include this as an attachment, others have them built right into the lid.

- Another useful feature for any scanner is the inclusion of a "hinged lid". This allows for scans from sources such as books and other things that are not flat and thin like a photograph would be; this ensures no damage to the original and/or distortion of the scanned image due to the original not sitting flat on the scanning surface.

- Compatibility of the hardware/software for the scanner to match the specs of the computer(s) you will be using it on; there is no point in getting a scanner with all the "bells & whistles" if you do not have a computer able to run it properly.

- The most common brands with the all-around features I am recommending are Epson, Canon, HP and Plustek. There are several other brands, but most generally have issues with cost or are very dedicated-purpose scanners.

What to avoid:

- If you do go the route of a scanner integrated into something such as a multi-function printer, make sure NOT to use the automatic feeder when handling anything except day-to-day documents which are not part of your archives. The roller mechanisms have huge potential to damage and even destroy a document and/or photo that is slightly fragile. Generally, the best quality scans will occur when the item being scanned is not in motion.

- To maximize the value of your dollar, a well-rounded scanner, likely in the $100-200 range will give you everything you need. If you start getting into specialty scanners such as those JUST for slides or negatives, your overall budget will tend to jump accordingly.

PORTABLE HANDHELD SCANNERS

There is another type of scanner that has become more popular in the Museum community is the portable handheld scanner. These have been around for a long time, but often lacked the features to be useful in day-to-day operation in a museum environment. The last few years have seen some innovation with these devices in that they have become easier to use, easier to connect and interface with other devices, have much better quality and often have optical character recognition built in.

These scanners can be useful in a number of situations including, but not limited to: scanning odd-sized documents, book pages, fragile documents or photos, items that cannot be moved without damaging or easily processed in a flatbed scanner and scanning documents off-site from the Museum location.

What to look for:

- There are a variety of models that all come with some standard features and keep the majority of models in the same approximate price range of $300+.
- The "standard" features that a decent handheld scanner will have are: being cordless, minimum resolution of 300 dpi, power-save capability, file formats for saving should at least include JPG and PDF, ability to store images onto a memory card (usually MicroSD) and the ability to connect to a computer.
- There are a few models that have additional or enhanced features including: rechargeable batteries, higher scan resolutions (up to 1200 dpi), wireless transfer capability to computers and/or iOS/Android-based devices, optical character recognition (OCR) and the ability to do translation.
- There are two very well-reviewed models made by IRIS that are currently out there which offer all of the basic features plus virtually all of the enhanced ones as well, and stays within the expected price range. The non-wireless model is the IRIScan Book 5 which retails for about $300 and the wireless model, the IRIScan Book 5 Wifi which retails for about $350-400.

FILM, SLIDE & NEGATIVE SCANNERS

With older photo media not always remaining in optimum quality as time passes, there has been more development of affordable devices that are able to easily/readily scan that media into a high-quality digital format.

These scanners are able to take still images most commonly from the following media: 4” x 6” prints, 35mm, 126, 110, Super 8 and 8mm film negatives and slides.

Useful features of these devices include image correction, ability to save to either computer and/or memory card, photo resolutions in the 15-20 megapixel range and TV/Video out connection for viewing on larger screens.

What to look for:

- There are essentially two “grades” of these scanners: consumer and professional.
- Consumer-grade models are made primarily by Magnasonic and Kodak. The price of these scanners are mostly in the $150-200 range, but can go as high as $400-500 for the Super 8/8 mm scanners. They are made with basic features, easy-to-use controls and their image sensors are typically limited to a maximum of 3,200 dpi optical resolution and 4,000 dpi interpolated (software-enhanced) resolution.
- Professional-grade models are primarily made by Plustek with their OpticFilm series. The price of these scanners start in the $500-700 range and go higher as the features increase. These more expensive models include dedicated media carriers for each common format and much higher quality image sensors producing optical scan resolutions just over 5,000 dpi and interpolated (software-enhanced) scan resolutions just over 10,000 dpi.

DIGITAL CAMCORDERS

Digital camcorders are versatile multi-function devices in the sense that they can record video, audio and even single images. In recent years, they have mostly replaced Digital Voice Recorders for the purpose of recording personal histories. In many cases, you get only one opportunity to record those stories, so reliability of your equipment is key.

What to look for:

- The first feature to look for is image stabilization – this means that the camera can account for a certain amount of "wobble" which is especially important if you are not using the camcorder on a tripod. There is nothing worse than having a shaky recording, especially when you often only have one chance to make that recording!

- The next feature to seek out is a low "lux rating" – this means the camcorder will be more forgiving in various lighting conditions and can still function well in an area that is not well lit. The closer the value is to 0, the better.

- Another important option to consider is the storage ability of the camcorder. This determines how much video can be recorded (ie. stored) onto the camcorder. Many of them come with built-in storage, so the more the better in that case. Almost all of them allow that storage to be expanded through the use of memory cards. The most flexible and best supported type of external storage is SDHC/SDXC because almost all companies use it. If you buy external memory cards, try to purchase a "Class 10" or "Ultra High Speed (UHS) Bus" card as they are fast enough to handle writing the video storage to memory. Getting a "lower class" card could jeopardize the quality and/or integrity of the data being stored on the card because it essentially cannot keep up with the camcorder.

- Connectivity options for transferring your video can range from just the regular USB cable and/or removable memory card to some of the newest camcorders being able to transfer and/or stream video using wi-fi and even controlling your camcorder remotely with a smartphone via Bluetooth. Technology in this area has come a long way but be careful only to get the features you need, as it can add to the expense of your purchase.

What to avoid:

- There are so many good quality camcorders available now, be sure to get one that has 1080p (1920x1080) resolution (aka Full HD) and 60 frames per second as a minimum standard. This ensures the quality of your video will be as high as possible. Avoid purchasing the less expensive camcorders that have specs lower than this. For the difference it makes, the very slight increase in cost makes up for it. Where 4K (3840x2160) resolution (aka Ultra HD) is more popular now, this has brought down prices in general which is good when shopping around.

- Avoid purchasing recorders that do not use Lithium-Ion battery packs. Modern camcorders are considered "high-drain" devices, similar to a laptop and require a battery capable of handling the power requirements and being re-used again and again. Lithium Ion batteries are less prone to developing a "memory" (which shortens their life) after being charged many times, compared to other types of rechargeable batteries. If running primarily on battery, invest in a good-quality spare battery and charger, rather than using the cheapest of what is available. The last thing you want is to run out of battery life in the middle of making a recording.

- In my experience and research, the Canon Vixia HFR and HFW series of camcorders continues to be among the best combination of the features I suggest and keeping the price reasonable. A good quality recorder in this series generally retails in the $300-500 range, depending on which features you want in particular, although sales can see even lower prices.

SMARTPHONE

A versatile option that shows great potential as a viable tool for museum use is the Smartphone. The features available along with the variety in pricing has made this a much more affordable option to consider when looking for something to accomplish several important tasks at a museum.

Suggested uses for a Smartphone in a museum setting include taking still photos, recording audio, recording video, large format/planetary scanning and of course playback of all those forms of media listed here. The possibilities are endless depending on how creative you want to be with it.

The great thing about them is that if you purchase one up-front, there is no need to use it as a phone. All updates and apps can be accessed and downloaded via a wireless internet connection. Once photo, video or audio files are created, they can be transferred off any number of ways including Wi-Fi, Bluetooth and USB cable.

Criteria to Consider when Choosing a Phone Model:

- With smartphones, the largest market share for a single brand is Apple which has almost a third of the global market. They have a limited model lineup each year and tend to be more expensive than an Android phone with comparable features. However, there is loyal following for them, a great selection of apps and usually high-quality hardware for all models which makes choosing which model to get more a matter of budget.

- The other two thirds of the market are Android phones, however there are literally thousands of options to choose from. There are the more popular brand names like Samsung, Xiaomi, Huawei, Motorola and Google. They tend to have the more expensive models on the market. But there are also budget-friendly ones out there and if you are considering one of those models, making a purchase online through companies like Amazon will often let you return the phone if it is not satisfactory to your needs. Saying that, it is always recommended to research that is the case for your purchase before finalizing it. The criteria listed below are the some of the things you want to consider in terms of features when using the smartphone for specific tasks.

What to look for:

- Taking Photos – a minimum of 12 megapixels (without optical zoom) is ideal; image stabilization is a must feature and depending on what types of photos you are taking, dedicated lenses for zoom and wide-angle shots are also great features to have

- Video Recording – a minimum of 1080p resolution at 60 frames per second and/or 4k resolution at 30 frames per second; video stabilization is a must feature, and if you can also get a model with higher frame rates, then it is quite possible to do slow-motion video recording

- Audio Recording – the actual quality of video recording the device is capable of is pretty standard among phones, what makes the bigger difference is the quality of the microphone; it is suggested to use a high-quality external microphone such as a lavalier-style one that connects via Bluetooth or cable

- Large Format / Planetary Scanning – this is not a feature of the phone in this case, but rather the function of getting the right accessories for the phone; which means a combination of a smartphone ¼’ clamp/adapter and either a high-quality tripod with flexible mounting options or a dedicated camera mount designed for this type of photography/scanning

Accessories to Consider Purchasing:

These items are just examples of ones that are out there but give you an idea of the potential type of accessories you can get to improve the functionality of a smartphone performing a particular task:

- Tripod *(portable tripod which can have attachments in multiple locations)*
  https://www.manfrotto.com/ca-en/element-mii-aluminium-black-mkelmii4bk-bh/
- Smartphone Clamp for Tripod *(attaches any smartphone to standard ¼" tripod mount)*
  https://www.manfrotto.com/ca-en/pixi-clamp-for-smartphone-with-multiple-attachments-mcpixi/
- Overhead Camera Mount *(sets up for large format/planetary scanning)*
  https://pozliv.com/product/pozliv-overhead-camera-mount-with-ring-light-flexible-articulating-phone-arm-stand-compatible-with-iphone-logitech-webcam-desk-tripod-for-youtube-live-stream-cooking-nail-video-recording/
- Bluetooth Lavalier Mic *(improves sound quality and gives flexibility on how/where to record)*
  https://store.dji.com/ca/product/dji-mic-2-tx-black

MOBILE INTERNET

When looking to provide a strong, consistent internet connection while either working remotely away from your main location or maybe your main location is not somewhere with reliable high-speed available through conventional, wired services, there are several options now available.

Cellular-based plans are most commonly available through the big providers: Bell, Rogers, Telus and sometimes through other companies in specific areas. The most popular satellite-based providers are Starlink and Xplore.

Devices most commonly available for mobile internet typically fall into one of three categories:

- Cellular-Based Mobile Hotspot
  These are devices that are typically battery-based and rechargeable and most commonly only allow connections via Wi-Fi, although a few models also allow a wired Ethernet connection too. These are the most flexible devices in that they can literally be used anywhere because they run off battery and can be easily supplemented by a rechargeable battery pack plugged in via USB cable. They typically cost $300-500 to purchase outright.

- Cellular-Based Smart Hub
  These are devices that are very similar to the Mobile Hotspot, except that they are more meant to installed somewhere with permanent power and always have both Wi-Fi and wired Ethernet connections. Their main advantage is that they can be the "permanent" replacement for a wired service in locations without those because they can be wired into a regular office network and provide wireless connections as well. They are typically in the $300-700 range to buy outright, depending on the model and extra features.

- Satellite-Based Hardware
  These devices are generally the most expensive option, as are the monthly plans, however they can often provide internet connections in remote areas or cellular "dead-zones". Depending on which hardware and plans you choose, they can provide both Wi-Fi and/or wired connections from their device. Hardware can REALLY range in price right now, typically $700-1000 however where this is currently a very competitive market, hardware promotions of up to 50% off the regular cost are not uncommon.

What to keep in mind for all device options:

- In all cases, the monthly cost for using any of these services will typically be significantly higher than a standard wired service (ie. Cable-based or Fibre-Optic-based), so it is important to choose a monthly plan for your connection that very closely suits your usage requirements. It is VERY easy to pay for more than you typically require depending on how you are using devices connected to your mobile internet. Take the time to shop around and compare what is available at any given time from different providers. Cellular-based plans can range from $10 to $150+ per month and satellite-based plans typically run from $120-200+ per month.

- To help narrow down your options for cellular providers, it also helps to research which ones have tower locations closest to where you will be using the mobile internet. I use the following site to research this and it has provided quite accurate and reliable in my experience:

  https://www.ertyu.org/steven_nikkel/cancellsites.html

  Put your address into the location search and then it will zoom in and you can then see which towers are closest to your location. You can click on each of the "flags" to see who has a transceiver on that tower.

- If you can afford to buy the devices up-front rather than on a contract, I highly recommend doing so, as this allows you to go onto a monthly-based BYOD (Bring Your Own Device) plan that does not lock you into a contract. This gives you flexibility to turn the plan on and off as needed, especially if your usage for the mobile aspect is only seasonal.

- If (or when) you shut off your plan for the season, etc. – the cell companies will offer to "suspend/pause" your mobile internet plan for a small monthly fee to keep your assigned cell number for that device. Where it is not being used for voice, there is NO advantage in keeping a number and paying that extra fee. The next time you go to use your device, you WILL usually have to pay a small activation fee, but in virtually all cases, that fee is much smaller than what you would pay to suspend the account in the interim.

- One helpful thing to keep in mind that will reduce your data usage especially when using computers on a mobile internet device is to make sure that you enable a setting built into Windows called "Metered Connections" which will optimize how data is used on that machine, as well as allow you to set limits on usage in a given period so for example, you do not go over your monthly limit and incur higher fees, etc. If you are using MAC machines, this can be similarly accomplished using third-party apps such as TRIPMODE.

BOOSTING WI-FI SIGNAL

There are so many different things that affect signal quality and strength and accordingly so many ways to address those, I will mention a few helpful tips and link here, to give a starting point on methods to best improve a Wi-Fi signal in a given space.

- I am not endorsing any specific publications or sites or any specific hardware recommendations they make, however this link has a thorough and well-explained set of recommendations on how to address boosting your Wi-Fi signal.

  https://www.pcmag.com/how-to/10-ways-to-boost-your-wi-fi-signal

- Over the years, I have literally tried and used all 10 of the recommendations made in the article on the link above. I would like to make a recommendation based on my years of experience on how it relates specifically to #9 and #10 which more involves the choice of hardware.

  After doing several dozen network installs over the years, I always come back to using a specific brand of wireless networking hardware which is ASUS. Most of their models (with the exception of the ones that end in -55 or -56) I have found consistently offer the following features:

  - High quality, durable hardware (I have installations using some of these routers that are working well up to 10 years later, with many others exceeding the 3-5 year reliability average of most other brands)
  - Easy, simple to use interface that is consistent across models and is frequently updated by the manufacturer
  - Integrated network security options making it simpler to secure your network
  - Multiple networking modes are available which offer great flexibility in setup options and include:
    - Wireless router mode (acts as the primary networking device for the location)
    - Access point mode (connects to a wireless router via network cable to extend network coverage at full speed)
    - Repeater mode (connects to a wireless router wirelessly and re-broadcasts the signal, albeit at a lesser speed)
    - Media bridge mode (connects to a wireless router wirelessly and gives the option to connect devices to it by network cable)
    - AiMesh node mode (connects multiple AiMesh compatible routers wirelessly to extend network coverage and can be more effective in larger installations)
  - Reasonable pricing on most models and I do find that this brand is quite frequently on sale several times each year, especially when the new models are released for that year

- One last tip I would like to share is that even though it can be a bit more expensive, I do find that when going the route of extending your network, that a proper router set in the right mode works MUCH better overall than most of the “plug and play” style mini-extenders that you can often find on the market.

DESKTOP COMPUTERS

This is a very broad category to comment on and I will only offer some very basic guidelines to help you in narrowing down your selections when out shopping for these.

What to look for:

- In past versions of this guide, I have had a strong recommendation towards Intel CPUs. That opinion has changed over the last few years as the main competitor, AMD, has completely stepped up and offered a very competitive line of processors that meet or even now exceed performance for a similar price point compared to Intel, generally offer comparable or better battery life and have a diverse enough line of products to be able to cater the full range from entry-level machines all the way to ultra-high performance machines. In terms of the value for the dollar, right now AMD is a bit better than Intel in almost all cases, BUT usually a bit harder to find with some manufacturers where Intel still has the largest portion of the market share.

- If making a new purchase, assume that you are going to try and make that equipment last as long as possible; in many cases, I have seen 5+ year old computers (and more often lately older in the 8-10 year-old range) as the common line in museums. Systems are often the last things to be replaced until the previous one either dies or there is an opportunity due to new funding or a grant.

- Keeping that in mind, if budgets allow, always try to buy a system with a CPU that is as CURRENT a generation as possible technology. With Intel CPUs that means look for at least 11th generation with the current being the 14th generation. For AMD CPUs, that means a CPU from at least the Ryzen 5000 or 7000 series. The previous generation systems are usually a bit cheaper to get and usually plentiful. When speaking from experience, having something as new as you can afford is the way to go when making equipment last as long as you can.

- Unfortunately, the naming system for both Intel and especially AMD can get rather confusing. Rather than try and summarize it here (there is no BRIEF way to do so), I am including a link to the following up-to-date article which gives a good overall explanation of the two brands.

  For the majority of the conclusions made in this article, I do agree with their assessments and recommendations… https://www.digitaltrends.com/computing/cpu-buying-guide/

- Beyond the CPU, there are many components which make up desktop systems these days, and the large majority of them are integrated right into what is known as the motherboard. Audio, networking, expansion ports, quite often video are now included. When speaking about RAM memory, ideally try to get something with a minimum 16GB of memory (DDR5 is the most common style right now, although DDR4 is still around) with 8GB still prevalent – if you choose a system with only 8GB, please make suer it is one you can upgrade later on if you plan to make that computer last for any length of time. Dedicated video cards in the context of museums are generally only needed when setting up a higher-end workstation such as one for graphics and/or video editing; otherwise, the popular on-board video cards will quite often suffice for general office use.

- The last thing to look at are removable media devices such as DVD drives, memory card readers and floppy drives. There is very little difference in most of the devices out there these days, so it is a safe bet to go with almost any of them. Many newer systems do NOT have any of these legacy devices installed anymore, although it is not uncommon to find at least an internal DVD drive installed for good measure.

- One area of note that has continued to improve dramatically over the last few years is internal storage media – this would be either hard drives or various types of solid-state drives. Which one you have in a system is often determined by the connectors built into the motherboard used in that system.

  The largest capacities and lowest cost are with the mechanical hard drives with common sizes up to 8TB (8000 GB) and going to a current single-drive maximum of 22TB (22000 GB). My own personal experience has seen best success with the Western Digital Black or Gold series of drives (and Blue series if very budget-conscious), although there are many brands and models to choose from.

  With solid-state drives, there are two major types which are different based on their type of "bus" (SATA or PCI Express). The rule of thumb is that SATA drives are the slower type and PCI Express based drives are dramatically faster. Common capacities for SSD drives go up to 4TB (4000 GB) and seem to be increasing all the time. And as newer generations of these drives are released, their speed seems to be increasing exponentially, making a huge difference in overall performance in even entry-level systems. Popular, high-quality brands of SSD drives include Samsung, Western Digital and Crucial.

- The last question I usually get is on what operating system to choose. With the end of support by Microsoft in 2025 for Windows 10, virtually all new systems now come installed with Windows 11. Saying that, Windows 10 STILL has almost 70% of the market share right now, so Microsoft may be forced to extend their official support for it (it will be interesting to see what happens). Where Windows 11 has been around now for 3 years, I would consider it a "mature" operating system and have no problem in recommending its use for most applications. So UNLESS there is a specific piece of older technology you are using that absolutely requires an older operating system, I would plan for using Windows 11.

  All new computers, unless they are Mac-based or Linux-based, generally come pre-installed with Windows 11. Thankfully for the most part, I have seen the benefits of using it over the past 3 years and have both built several new systems running it. There is a recommended minimum hardware requirement for Windows 11, however it can be bypassed relatively easily, and I have found that Windows 11 does run fairly well even on older systems (I have put it onto systems up to 10 years old!). As with past versions of Windows, there are two "editions" generally available on new machines – namely HOME and PRO. I always recommend PRO unless budget or availability is an issue. The good thing is that Windows 10 and 11, and HOME and PRO editions of both versions of Windows all work well together in a "mixed" network allowing them all to "see" each other and work well together. So at the end of the day, there is not a big stress to make sure all of your machines are running the same version AND edition.

  One continued complaint of people using Windows 10 AND 11 is the change in the user interface, as Microsoft removed/changed their familiar Start Menu, as well as some of the other common control panels. Thankfully, there is free software out there that will "bring back" the familiar Start Menu called OPEN SHELL. You can simply Google it and download the latest version, which will work on Windows 10 and every other version of Windows back to XP. For other functionality that was removed, it generally comes down to a personal preference. In virtually every case of something being different in Windows 10 or 11, someone has created a free utility that then replaced it with something you can recognize. It again, is just a matter of searching Google for Windows 10/11 utilities and you will see there is a lot out there freely available. So don't be afraid of going to Windows 10 or 11 – some of the other newer features are quite useful and more flexible than in previous versions of Windows, so there ARE benefits to running the latest version!

- In terms of average cost, assuming it comes with a decent wired keyboard and mouse, good quality parts and at least 1 year warranty, usually without a monitor depending on sales out there, you should be looking around $600-800 + taxes for an entry-level system, $800-1000 + taxes for a mid-level system and $1000-1200 & more + taxes for a higher-performance system. Unless it is a fabulous sale or clearance, any prices below those ranges I would look at with a very close eye to make sure it offers all that it should.

What to avoid:

- If buying a desktop pre-built off the shelf, I would highly recommend doing a bit of research online to see if you can find reviews on that model or one very close to it. Be sure to look at both expert reviews and consumer ones as well; they will usually identify very different points of view on the same product. From my own experience, I am not a huge fan of brand-name boxes, but if you want to go this route, my best track record has been with Dell, ASUS and HP's business lines (formerly Compaq). I would suggest looking at their business lines, rather than their consumer ones, as they tend to be more reliable and have the features in the system where most museums need them to be.

- If buying a desktop custom-built from a local shop, the biggest things to look for are reputation and longevity of the business you are dealing with. In the event of problems, you want the place you are dealing with to be around at that time. It does not hurt to do a bit of research on the businesses you are looking at by talking to other local organizations and businesses to see who they use and what their experience has been like with them, especially in the after-service category. Most reputable shops will use good quality parts because if they do not, customers will not continue to go there, and they will lose business in the long-term.

NOTEBOOK COMPUTERS

Many of the guidelines that I wrote for the desktops are very similar to what I use for notebooks. I will simply point out any differences unique to notebooks.

What to look for:

- When deciding whether to purchase a notebook rather than a desktop, it is always most important to look at the specific usage and how much need there really is for portability and compactness. In terms of "bang for the buck", desktops generally beat out notebooks every time. However, if having a notebook in a certain role makes a lot more sense, then it is a sound investment.

- The day has also come where many notebooks are being designed as "desktop replacements" and in many roles, such as the average office, they can easily hold their own and not cost an "arm and a leg" anymore.

- The biggest features that will generally distinguish the price levels in notebooks are the CPU, the hard drive size, type (and speed!) and the video capabilities.

- The biggest impact on price will always be the CPU choice for the laptop. As with desktops, there is no simple way to explain all of the differences here, so I refer to a well-written article which simplifies things and has some sound recommendations, see: https://www.digitaltrends.com/computing/cpu-buying-guide/

- With internal storage, the biggest influencing factor these days is the storage capacity. Very few current generation laptops still have hard drives. The standard for almost every model out there now is a solid-state drive and most commonly the PCI Express based ones are used because they have come down dramatically in price and have constantly increased in performance, making laptops much lighter and faster overall.

- Video capability is usually the last major factor when looking at notebooks. Just like desktops, video cards can either be integrated or when separate, they are referred to as "discreet" cards in a notebook. Discreet cards are almost always faster, but almost always more expensive as well. The same rule applies as for the desktops – if you need it, get it, otherwise most often the onboard type will work just as well.

  The types of "VIDEO OUT" ports are another thing to look at. More often now, notebooks are hooked up to external monitors and/or televisions and the standard port these days is HDMI. The older VGA connection which used to be popular on laptops has essentially disappeared. If you do need to connect your newer laptop to older equipment that still use the VGA connection, there are HDMI-VGA adapters which are readily available to solve that issue.

  The other connection that is quickly growing in popularity among laptops, especially those considered high-performance, is "DisplayPort over USB-C". This is a faster, more versatile connector than HDMI and I can see it becoming the new standard over the next few years. If you can get this as an option on a laptop you are buying, I feel this will help future-proof your machine to a degree. I should add a special note that not all USB-C ports have this capability, only those with the "DP" DisplayPort logo beside the port will support this new standard, so be sure to do your research if wanting to make sure you have this feature.

- In terms of average cost, laptops can REALLY vary because of the large variety of configurations available. Typically, though, they can be very similar in cost to desktops for each of the levels (entry-level, mid-level, high-performance, extreme performance) listed in that section.

What to avoid:

- In general, you will always buy a notebook off the shelf unless going through a special-order company such as Dell, where you can specify what you want to a greater degree in terms of particular parts and features. I cannot stress how important prior research is to making a sound purchasing decision. Checking reviews on the models you are looking at is usually most helpful, as there are both excellent finds and lemons out there. My current brand of choice due to their broad variety of models, price ranges and feature sets is ASUS. A close second is usually between the business lines of Dell and HP (formerly Compaq).

NETBOOKS, CONVERTIBLE NOTEBOOKS & TABLETS

There are a number of other portable options that are quickly becoming available at reasonable prices. These include NetBooks and Tablets. It should be realized from the very beginning, that none of these types of devices should really be considered for general day-to-day office use. Instead, there are specific purposes these should be considered for.

Another option which merges the features of both notebooks and tablets are often referred to as "Convertible Notebooks" or "2-in-1 Notebooks" because they are essentially a tablet that attaches to a whole bottom portion which includes the keyboard, ports, additional battery, etc. This option is usually on the more expensive side of things and should only be considered with a very specific purpose in mind accordingly.

What to look for & what to avoid:

- When looking at NetBooks, you must keep in mind that despite looking like miniature laptops, they are nowhere as powerful in any aspect and at best, are useful for the functions of internet surfing, e-mail and the like. If you are considering purchasing one, they are best suited for the function of a "patron" workstation or for one used for web-based research or entry, such as in a museum library and/or archives. To use these for anything else, such as an office setting would be setting yourself up for frustration from the very beginning. An average NetBook is typically in the $150-200 range, sometimes as much as $300 depending on what extra features may be added onto it. There are several manufacturers of these, with one of my preferred again being ASUS.

  There is also a subcategory of NetBooks out there called "Chromebooks" which are called this because in terms of their hardware, they are usually very similar to NetBooks, however instead of running a version of Microsoft Windows (or Linux), they instead run "Google Chrome OS" which is a proprietary version of Linux made specifically for this line of hardware. From a museum's perspective, their usefulness is VERY limited, as there are very few applications out there to run on it that would be helpful beyond basic office functions. I would not recommend the purchase of a Chromebook for use in a museum setting unless strictly used for surfing the web, etc. – maybe as an Internet research workstation.

- Convertible Notebooks (aka 2-in-1 notebooks) are essentially a mixture of a high-powered tablet plus all of the other parts that would normally come with a notebook such as the keyboard, various ports, additional battery, etc. They are usually very flexible in how they can be used and quite often are as capable as full-fledged notebook in most uses. They do tend to be on the more expensive side, and due to their cost, would likely have limited application in most museum environments. If you feel you do have a use for the particular advantages of such a set-up, the most common ones out there are the Microsoft Surface Pro series and the Lenovo ThinkPad Yoga series.

- Tablets when properly applied, can have a place in a museum setting. Again, the idea of office use is a non-starter, however I have seen them used in projects such as virtual/interactive docents or even used as interactive touch displays beside an exhibit. Their use depends a lot on the creativity of the museum's staff and how far they want to venture into this type of technology. It is appearing more and more often now, especially in combination with things such as QR codes, where for example, a related video could be shown when the code is scanned beside the relevant object within an exhibit. Smartphones often have this capability as well, however if the museum would like to provide the interactive experience to the audience at large, rather than those few with their own equipment, it is a great way to keep the exhibits fresh and interesting.

There are now two common flavours of tablet out there: iOS tablets otherwise known as iPads by Apple, and the most popular, Android-based tablets are made by a multitude of companies.

iOS-based tablets (some iteration of the Apple iPad, iPad Mini or iPad Pro) has a handful of sub-models within each generation and the are currently 3-4 major generations widely available at any given time. When a new generation is released, the absolute cheapest ones are just over $400 and the most expensive are now over $2500. Pricing is standardized and strictly controlled by Apple, so you will not see any HUGE sales on these devices and generally if you see it one place, you will see it at many retailers around the same timeframe. The main benefit of iOS devices is the sheer number of apps available for them and people's familiarity in using them. In terms of how the actual hardware compares to the others, they are typically in the mid to high range of the features & performance and their size is in that 8" to 11" range at the moment, however there are 11.0" and 12.9" models also available in the iPad Pro series.

The other type of tablet, the Android-based tablet is a hard one to describe because there are so many different hardware and software combinations on the market. In terms of hardware, they truly range from the very low end to the fastest tablets on the market. They are also generally priced accordingly on their hardware capabilities. The cheapest ones are under $100 and even the most expensive ones top out around $1400+ due to their size and multitude of extra bells & whistles. The smallest tablets are generally in the 7" size range, while the largest ones are as big as 24" wide (and they are not even the most expensive ones)! The vast majority are in the $150-350 price range and the 7"-10" size category. The key thing to be looking for once you have determined your hardware needs and budget, is which Android operating system is installed. The absolute newest one, at the time of writing, is Android 14 and is only available on a handful of the newest devices, primarily those made by Google/ASUS or Samsung. The most common versions of Android on the market right now are 9 through 13. There is a big difference for the next step down in the operating system in terms of capabilities and flexibility and user-friendliness, so at this point, I would recommend purchasing a tablet that has AT LEAST version 11 and newer if possible. As well, Android version updates are typically only available for a maximum of 3 years from the initial release of that version, so keep that in mind when comparing purchase options.

In terms of "bang for the buck", generally the best devices to purchase will be Android-based tablets. However, there could be certain situations where the app you want to use is available for iOS only.

DATA BACKUP OPTIONS

There are generally three popular methods of backing up and storing copies of your important data. An effective backup strategy generally uses at least two of these methods together, with the premise of having something easily available on-site (or can be quickly brought on-site) and also having something off-site in the case of a catastrophic emergency such as a fire and/or even a flood.

The first is to use equipment that remains permanently connected to your computer(s) and/or network – this includes external desktop expansion hard drives and what is known as network-attached storage, which is basically an external hard drive (or group of them) with the ability to be accessed directly by your computer(s) across your network, rather than through a device cable.

The second is to use equipment that is removable and can be easily taken off-site – this includes portable external hard drives and flash (aka "thumb" drives).

The final method is to employ the use of online backups, which relies on an internet connection to transfer your data which is then stored on remotely located servers.

Pros & Cons and What To Look For & Avoid:

- The first method of using permanently connected equipment does have the advantage of rapid access to your data, both when backing up and restoring it. It does have the disadvantage of not being able to be taken off-site on a regular basis, so this limits its usefulness in the case of a catastrophic emergency.

  Desktop external drives can range between $150-600 and the storage capacity of this style of system can be as big as 20TB (20000 GB) at the moment; it is typically connected to a single computer and then shared onto the rest of the network through that computer.

  The other style of on-site storage is referred to as Network Attached Storage (NAS). It is usually comprised of one or more hard drives put together into a single enclosure and sometimes even setup to be mirrored, so that the data is copied onto two identical drives in the event that one of them fails in the future. This enclosure is then connected onto your network via an Ethernet cable. The simplest and cheapest of these enclosures (without hard drives installed) can start around $300 and can run into the $2000+ range depending on what you decide to purchase. They also require the purchase of one or more hard drives (best ones are those optimized for NAS usage) which add to the expense depending on the size and number of drives installed.

  In both cases, the brand of hard drives that in my experience are the most reliable are made by Western Digital. For NAS enclosures, this would be their "Red", "Red Plus" and "Red Pro" product lines. For the desktop expansion drives, the line of preference for me is the Western Digital "My Book" series. For the enclosures, the most common brand that includes the hard drives are those made by Western Digital in the "My Book" and "My Book Pro" series. For the enclosures that do not include drives, good quality ones are made by Synology, QNAP and Thecus.

- The second method of using portable removable equipment does have the advantage of both rapid access to your data, both when backing up and restoring it and still having the safety of being off-site in the case of a catastrophic emergency. If can only use a single method of doing backups, this is what I would suggest as your solution.

There is the option of both portable, external hard drives and flash drives. For the purpose of relying on equipment long-term for data storage, experience has shown me that flash drives are not the best solution even though they have come down dramatically in price in recent years. Despite having no moving parts, the vast majority are not made to be used for transferring large amounts of data on a very regular basis. They are wonderful for carrying data from point to point on an occasional basis, but when used too often most of them will eventually "wear out". The other major disadvantage is their limited capacity. The absolute largest size right now for flash drives is 2TB and those drives cost more than many external hard drives (not being practical or cost-effective at all). Flash drives do have their place and are very useful tools, but I would highly recommend using portable external hard drives as your regular backup solution.

The portable external drives can be bought in capacities up to 5TB (5000 GB) and are rather affordable with 1TB models averaging around $70-80 and 2TB models averaging under $100. They are small and robust enough to be carried back and forth and are still generally fast enough for data transfers for your backups. The main brand of preference in the last 5 years for me is the Western Digital "My Passport" series with the Seagate "Backup Plus" series as a close second.

One positive development with external drives in the past few years is the introduction of Solid State Drives rather than the mechanical drives used for the past couple decades. They have the major advantage of speed over the older-style drives, can be more robust and durable due to no moving parts and are purpose-designed for large amounts of data transfer. The main disadvantage is they are more expensive when compared to the same size mechanical drives. 1TB drives start around $200 and they can go all the way to 8TB which is often over $1000. However, if your budget allows for it, they are an excellent option in my experience. My personal toolkit has switched to using this style of drives almost exclusively. The brand of preference in my experience is Samsung. They have been the technology leader in this type of storage from the very beginning.

- The final option is the use of online data storage services. The primary benefit is that it provides a secure, off-site storage area with redundant drives and often redundant servers and can be accessed from virtually anywhere you have an internet connection. Many services offer storage capacities now up to 100TB (some even more), but the main disadvantage is the ongoing cost incurred in order to both store and access your data and the requirement to have a high-speed internet connection. To be practical, you will want at least a download speed of 50-100 Mbps and a bare minimum upload speed of 10 Mbps. In the case of some rural or remote locations, this may not be an option as it may not be available and for smaller museums with a very limited budget, the cost of a high-speed internet connection plus the added expense of the storage service may not be affordable. Another challenge is that the internet connection speed controls how quickly you can both backup and restore your data and if it is a large amount of data, then it can take a significant amount of time.

  Another concern around the use of online or "cloud" storage as it is quickly becoming known, surrounds privacy issues and laws. There is a lot of confusion surrounding this matter and the basis is whether or not an online storage service that is physically located outside of Canada is allowed to be used. The bottom line for Nova Scotia museums comes down to whether or not your museum is considered a "public body". Nova Scotia's anti-export law requires that information under the custody and control of a public body be stored only in Canada and accessed only in Canada… If your museum is not considered a "public body", then technically you have the option of using a non-Canadian service provider.

  See this Google Doc link for a much more detailed explanation:
  https://docs.google.com/document/pub?id=1R1llPEAryOns9eJZ0c1o4zgH-vqUlA7TvVBfbx50Xak

For well-established Canadian companies that provide online backup services located in Canada, the following ones offer affordable services: CloudPockets.com, MasterMindBackup.com, SherWeb.com, ThriveNextGen.com and Sync.com.

Comparable American companies tend to offer more storage for less cost, but this is only an option if you are not subject to Nova Scotia's anti-export law – the company I have the most and best experience with and would suggest looking at is IDrive.com.

DISCOUNTED SOFTWARE & EQUIPMENT PROVIDERS

One trend that has increased in popularity is corporate giving of software and/or equipment to registered non-profits and charities. There are more and more ways that you can potentially save money if your Museum is registered as a non-profit or charity. Below are the most popular ones out there at the moment:

- **TECHSOUP CANADA**
  The longest-standing group that has been partnering the corporate and non-profit world is an organization known as TechSoup. It works with many of the largest software companies in the world to give non-profits easy access to software donations from those companies. The savings realized through this service are phenomenal, with savings as much as 95% possible.

  The program assists your organisation by making donated software available for a very low administrative fee, thereby helping you to make the most of your ICT purchases and infrastructure. Receiving technology product donations frees up stretched organizational budgets for both technology priorities and other programme areas. Software and other technology products can be more than just mere acquisitions; their website helps you to make the most of your ICT purchases and infrastructure by providing resources and advice on technology planning, ICT tips and tricks, and other technology assistance you may require.

  If you have not already signed up with TechSoup Canada (the Canadian arm of this organization), no matter what size museum you are, I highly recommend that you visit their web site at https://www.techsoup.ca/ and begin the registration process. It does require a bit of legwork to provide all the necessary documentation, however it is well worth your time and effort.

- **PERCENT**
  A much newer company that provides services similar to TechSoup is Percent. They are slowly taking some of the market share that used to belong to TechSoup. For example, they ow handle all of the applications for Google-powered services and other well-known companies such as LinkedIn and Asana. You can start the process of seeing what they have available by visiting them at https://causes.poweredbypercent.com/

- **CHARITY-FINDER SOFTWARE DISCOUNTS**
  This site is simply a database listing of companies that offer non-profit and charity discounts on their software and online services. Each listing provides a link to how/where you can get more information on what each company offers. It is worth a look to see if there is something that may be of interest to you. The link to their resource page is https://www.charity-finder.org/non-profit-software-discounts-offers/