AITS Newsletter

APRIL 2025

Enjoy this brain teaser ☺

The lovely but not terribly-bright contessa was swindled of her jewels. She knew that her beautiful pin had nine diamonds down each side, and across the top/bottom. These were clustered as shown below but she had never examined the arrangement closely. A clever thief figured out a way to steal four of the magnificent diamonds so the contessa did not miss them. He reset the diamonds so that there were still nine diamonds on each side of the pin but only 20 diamonds in total. How did he reset the jewels to get away with 4 of them?

3	3	3
3		3
3	3	3

NIST Password Rules, Recursion, And the Morning Drive

[Abraham John, Asst VP, AITS]

As usual my "fluff" piece for this newsletter is again, just that a fluff piece that all this newsletter's readership may find interesting or have already spent time considering over the years!

The first item, not fluff, is the new password rules that the National Institute of Standards and Technology (NIST) published late last year. Passwords are something we all use in some form or fashion and hopefully you are using a passphrase so that it is naturally longer. I know of at least one department that is "playful" in their business but lives and breathes good passwords and it is not IT or Information Security since that is hardcoded into our DNA! NIST has updated its Digital Identity Guideline publication NIST SP 800-63B-4 2pd - NIST Special Publication 800-63B and some of it is outlined below from the NIST publication.

Password Verifiers and Credential Service Providers (CSPs)

- **SHALL** require passwords to be a minimum of 8 characters in length and **SHOULD** require passwords to be a minimum of 15 characters.
  - We should all keep our passwords longer than 8 characters and ideally should be on the upper limit of the NIST recommendation of 15+ characters.
- **SHOULD** permit a maximum password length of at least 64 characters.
  - I was pleased to see this item being stated as "at least" so ideally more than or equal to 64 characters. This allows users to use passphrases that might be easier to remember and reduce the reasons to write them down.
- **SHOULD** accept all printing ASCII characters and space character in passwords.
- **SHOULD** accept Unicode characters in passwords.
- **SHALL NOT** impose other composition rules for passwords.
- **SHALL NOT** require users to change passwords periodically. However, verifiers **SHALL** force a change if there is evidence of compromise.
  - I am not entirely certain of this but it is understandable that if a user selects a very good, strong password changing it on a set schedule may lead to users selecting weaker passwords to not have the burden of coming up with new strong passwords.
- **SHALL NOT** permit subscriber to store a hint that is accessible to an unauthenticated claimant.
- **SHALL** verify the entire submitted password
- Verifiers and CSP's **SHALL NOT** prompt subscribers to use knowledge-based authentication or security questions when choosing passwords.

If Unicode characters are used in passwords, they verified **SHOULD** apply normalization process for stabilized strings with either NFKC or NFKD normalization as defined in 12.1 of Unicode Normalization Forms. Subscribers choosing passwords that contain Unicode characters **SHOULD** be advised that some endpoints may represent some characters differently and would affect their ability to authenticate successfully.

The verifier **SHALL** compare the entire password against commonly used, expected, or compromised passwords.

If the chosen password is found to be on the blocklist the verifier **SHALL** require the user to select a different password and **SHALL** provide the reason it was rejected.

Verifiers **SHALL** allow the user of password managers. These are a good aid in users selecting strong passwords especially if the password manager includes a strong password generator.

- I am on the fence on the use of password managers especially if they are cloud based.

While not related to selecting passwords, NIST recommends the use of Multi-Factor Authentication (MFA) for all systems except for the ones that really don't need any protection since they do not have anything of consequence. I look at these systems not from the perspective of what they have but rather from the door they might open to a potential attacker. I would prefer to protect systems that do not necessarily carry compromising data as well.

As you have time, read the NIST publication as time allows. I am sure you will find t interesting.

I encourage the AITS newsletter readership to consider passphrases and challenge yourself towards the upper limit of the new NIST standard or at least 24+ characters 😊 for your passphrase along with MFA!

Spruce: four-sided needles that grow singly around hairy twigs. Eat young shoots, inner bark, and use needles to make tea.

Recursion

I know, that word – recursion - just makes it seem so complicated but really recursion is just the process of breaking a problem into smaller parts of the same and using the same techniques to each part until we reach a point where what we have is so simple (base case) as to not need any further reduction. In computing this is an approach where a function calls to solve a problem and will call itself until the base case is reached. I was thinking about tackling Euclid's algorithm implementation in this issue but realized that I have not done one on recursion, and that concept will be used when implementing a solution for Euclid's algorithm for Greatest Common Divisor (GCD). So we will step into recursion for just a bit.

Recursion offers a very elegant way to solve certain types of problems that lend themselves to be broken into simpler instances of the same problem. Some of these are Fibonacci numbers, powers of a number, tree traversal like depth or breadth first searches, sorting like merge/quick, permutation and combination problems or algorithms that employ divide and conquer.

The question to ask is, can the problem be broken into smaller steps and if it can, then recursion may be a good choice. It can be more straightforward to implement when compared to an iterative approach. But we should also be careful that we do not choose recursion if it is less efficient or if there is risk of running out of stack space. We can also employ techniques of memoization or tail optimization to make our recursive function more efficient.

Here is a very simple implementation of the Fibonacci sequence using recursion in PowerShell. This will produce the output shown to the right of the code.

```
function Fibonacci ([int] $n)
{

    if ($n -le 0)
    {
        return 0
    }
    elseif ($n -eq 1)
    {
        return 1
    } else {
        $x = $n - 1
        $y = $n - 2
        return (Fibonacci ($x)) + (Fibonacci ($y))
    }
}

for ($i = 0; $i -lt 10; $i++) {
    $fib = (Fibonacci ($i))
    Write-Host $fib
}
```

```
0
1
1
2
3
5
8
13
21
34
```

Anyone want to guess what the number after 34 would be? 😊

The Morning Drive
The other item that I was recently fascinated by was dry powder flowing in a glass of water. This came about when I was putting a couple of tablespoons of supplement powder into a glass of water that I drink as part of my morning ritual – yes – we ancients take something called supplements 😉. I noticed that the dry powder stayed on top of the water for about 3 to 4 seconds before it started to funnel down to the bottom of the glass. It was an interesting and pretty sight, albeit for just a few seconds. On my drive to work that morning I started considering the forces that were in play for that effect to take place. I am sure the experts and hobbyists in fluid dynamics among the readership will find this elementary, but it kept my mind occupied for the 12 mins it took to get to work. The factors I came up with are listed below.

- Particle shape – circular particles will flow better than ones that are irregular in shape and will have smoother surfaces.
- Particle size – are they particulate of some significant size or are they fine particles – example flour.
- What type of liquid and how effectively it wets the dry powder – think water vs. syrup or honey
- Surface tension of the liquid
    - If you have ever seen a water strider insect or reptile then you have seen how surface tension will make it seem like these creatures appear to walk on water. See water strider- green basilisk - information shown to the left part of this page.
- What is the stickiness of the dry power particles – electrostatic forces – the cohesive properties and as the water wets the dry powder particles the cohesive properties are overwhelmed.
- How tightly packed are the dry powder particles
- Must not forget gravity – the big G 😊

As the particles came in contact with the liquid and as it wet the dry powder, cohesion failed and the individual particles started to fall at an increasing rate to the bottom and as the particles fell it created almost a vortex in the middle that then dragged the dry powder from the sides creating a whirlpool effect. With something that has the fineness like flour given the cohesion there is bound to be clumping – maybe will play with this over the weekend 😊 - and there would not be a funnel effect. Not sure if this answers everything but it was a good thought exercise driving in or I may be completely off in my considerations given my enthusiasm to get to work that morning 😊.

I hope this not entirely serious piece leaves you with an appetite for some serious articles now that we have had our laughs out of the way!

Green Basilisk lizard also called the Jesus lizard that is native to Mexico, Central America, and South America.

Optimizing SEO via Accessibility

[William Schuelke]

SEO (Search Engine Optimization) has moved beyond digital marketers trying to fine tune webpage meta data to rise in the ranks of results to become a common phrase tossed around in departmental meetings about "the website." But what does it mean in the context UNT's web environment, and what is a practical way for editors to work towards a better rank (and why should they)?

Search Engine Optimization has become a catch-all phrase for ensuring that the content of your website is the first result, or as close to it as possible, when users search for information using keywords that relate to the site content. For example, a search for UNT News will have news.unt.edu as a top result because it is the official news site, as opposed to departmental news pages or newspaper article about UNT. The reason SEO matters is because it helps our target audiences find the content that relates to their needs and engage with the university. To this end, marketing firms have spent countless hours trying to reverse engineering the algorithms used by search providers to find ways to get their pages ranked above everyone else. But there is another way.

What can editors across campus do in their regular workflows to improve their pages' rank without learning the deeper mysteries of "the Algorithm"? The strategy that can work for everyone is enhancing web accessibility and updating content, rewriting content regularly to include keywords in the body, as opposed to spending time trying to include several dozen keywords in the meta data.

Cottonwood: Leaves are oval to heart-shaped. Inner bark and sap are edible.

There also are a few things to keep in mind about web accessibility in the context of UNT's websites. First, web accessibility is part of the ADA (Americans with Disabilities Act) and there is new guidance regularly being published in the federal register relating to how websites, especially for public institutions like UNT, need to comply with the law. In addition, there is a strong ethical need for editors at UNT to prioritize accessibility, because as an institution of higher education, we have students and employees of all backgrounds, and everyone has a right to utilize our digital resources.

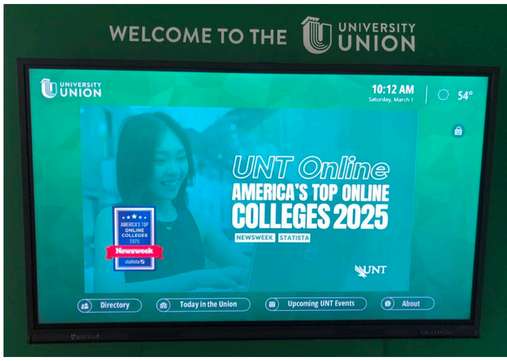
The link between SEO and accessibility is not a new discovery. The spiders/bots that crawl websites to analyze the content, feed information into the search engine and rank pages need to be able to understand what content is on the page, how it is organized, what the main idea is and what search results should include this page. Another consideration is how users that go to the page interact with it, do they bounce and leave quickly (within 3 or fewer seconds) coming back to the search results or do users stay and engage with the site and click through?

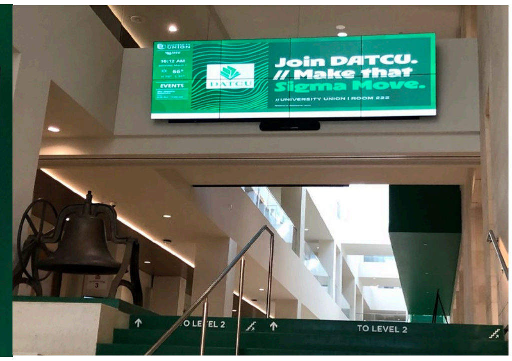
Accessibility comes into play here because, for example, accessible sites have their headings ranked from most important to least and organized more or less like an outline. For example, the H1 on the page is the primary heading in the banner and subsequent headings are organized and nested down. In addition, accessible sites use alt text so that images are explained as they relate to content, have good color contrast between text and backgrounds, and do not use vague actionable phrases for buttons or links like "click here" or "read more." Accessible content is also much easier for all users to engage with, find the information they need quicker, and interact with, leading to better user outcomes (conversions), which influence SEO as well. The key here is also recognizing that SEO isn't just about getting users to the page or generating impressions in search results but about getting the right users the right information to make a decision. To this end, the search engine must be able to determine if the website leads to measurable benefits for the user. Looking at the results of well-optimized pages analytically might show fewer total visitors or impressions, but longer session times, more conversions, more engagement and a greater number of return users. Ultimately, while accessibility might not be specifically listed by search engines as part of the ranking algorithm, accessible pages provide a better user experience, are easier to index and lead to overall better user outcomes, factors that do impact SEO.

Campus communication: The role of digital signage at UNT's University Union

[Jesus Chavez]

Have you ever taken a stroll through UNT's University Union and wondered how all the TVs, room signs, and digital displays seamlessly show ads, events, and designs in real time? From next weekend's football game against UTSA to upcoming campus activities to important announcements, these digital screens work around the clock to keep students, faculty, and visitors well informed. But have you ever thought about the technology behind it all? Behind the scenes, AITS ensures that every update, transition, and graphic runs smoothly bringing the University Union's vibrant energy to life on large and small screens alike with just a few clicks.





Maple: Leaves zre coarsely toothed lobes. Fruit is a two-winged samara. Seeds, sap, and inner bark are edible.

Why Use Digital Signage?

Firstly, what is the point of Digital Signage and why use it? Digital signage is an efficient way to communicate a variety of information to a large group of individuals in real time. It replaces the old traditional paper printed signage with digital displays that can be remotely updated, making it ideal for large diverse environments that require frequent information changes, such as universities, airports, and corporate buildings.

Some reasons to Use Digital Signage are:

- **Allows real-time updates:** Changes to event schedules, emergency notifications, and announcements can be instantly made from a remote location.
- **Cost-Effective:** Thanks to the digital displays the need for paper and printers is reduced and so is the cost and waste of those printed materials.
- **Eye catching & Interactive:** Allows for people to interact with multimedia content, including images, videos, and fun interactive programs.
- **Centralized Management:** A single IT Support individual can control multiple displays across different locations from one single choke point system.
- **Better Visitor Experience:** Provides clear wayfinding, event details, and campus information for visitors such as first time visitors from orientation.

How Does Digital Signage Work?

So how does a digital signage system create such eye-catching content? Digital signage systems typically include a number of pieces that bring the whole thing together. These pieces are:

- **Content Management System (CMS):** The backend software where administrators create, schedule, and manage content.
- **Data Integration:** Digital signage can pull live data from external systems such as event management software as well as security alerts.

- **Media Players:** Small hardware devices connected to each display, pulling content from the CMS. In UNT's Union case we use the small OptiPlex Micro Form Factor which are small desktops that we can mount behind large displays.
- **Display Screens:** This usually consists of physical screens that show the content. The most common physical screens tend to be large TVs and other display screens.

Here at UNT, digital signage integrates with Event Management Systems (EMS) to provide real-time updates on room reservations, meetings, and special events.

Benefits of Using Digital Signage in the University Union

UNTs University Union serves as a central hub for students, faculty, and visitors. Digital signage enhances its functionality in several ways:

1. Efficient Event Communication

- Displays real-time room schedules and events.
- Reduces confusion by providing accurate, up-to-date room availability.
- Helps with last-minute room changes without requiring printed materials.

2. Enhanced Campus Navigation

- Interactive wayfinding kiosks guide users to meeting rooms, departments, and services.
- Reduces congestion and confusion, improving the visitor experience.

3. Emergency Alerts and Notifications

- Displays urgent safety messages across all digital screens.
- Helps communicate building closures, severe weather warnings, or security alerts instantly.

4. Sustainability and Cost Savings

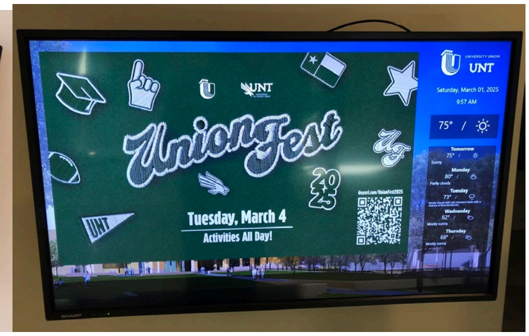
- Eliminates the need for printed flyers, posters, and schedules.
- Saves costs on paper, ink, and labor for maintaining printed signage.

Clover: Ground hugging plants. Entire plant is edible.

Cattail: All green parts of this plant are edible.

5. Increased Student Engagement

- Promotes student events, clubs, and campus activities for students to join one of the over 450 student organizations on campus UNT has to offer
- Displays important university deadlines and reminders.



Digital Signage in the University Union

Here at UNT we use REACH Digital Signage software for our interactive and non-interactive signage. REACH Digital Signage software is a **cloud-based digital signage platform** that enables organizations to manage and display content across multiple screens in an extended area. Some of the features REACH Digital Signage software provides are:

- Web-based content management which allows us to update displays remotely.
- Integration with external systems like EMS to pull real-time event data.
- Support for multimedia content, including videos, live streams, pictures, and interactive elements.

The room signs throughout the Union use Fourwinds to display details about ongoing events in the associated room.

Event Management System

Here at UNT we also use EMS. EMS is a comprehensive scheduling system that manages:

- Room reservations
- Event scheduling
- Resource allocation such as A/V equipment and catering
- Integration with building automation systems

EMS also works with building automation systems to optimize space usage and resource management through the building. This is done through two main ways:

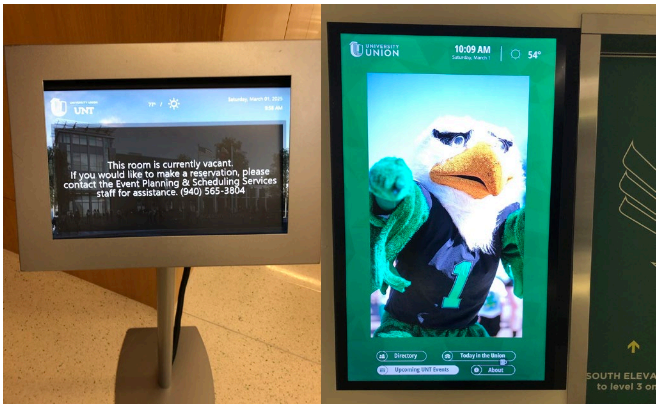
1. HVAC and Lighting Control

- EMS schedules are used to adjust room temperatures and lighting.
- The system ensures that heating, cooling, and lighting are only active during booked events, reducing energy waste.

2. Security & Access Control

- **Automated door locks:** Doors unlock when an event begins and relock after it ends.

Event-based access: Only authorized users can access certain rooms based on event registration.



The Integration with EMS

Fourwinds Event Data is exported from EMS with the use of a Web Deploy server. On the Web Deploy server there are two scheduled tasks that run every hour. One task generates event data for each Union event space in an XML format. The second task runs ten minutes later and copies those XML files to a location on the shared drive. The room signs throughout the Union use this XML files to display details about ongoing events in the associated room.

REACH Digital Signage and EMS work together to provide a smooth communication system within the University Union. EMS generates event schedules, which are then stored securely on the university's internal network. REACH retrieves this data and updates digital signage across the Union, ensuring that information is accurate and up to date. A big benefit of this automation is that it eliminates human error and minimizes the workload for staff, who no longer need to manually update event details on each individual screen. This back-end system operates exclusively within the university network, preventing external access and ensuring that only authorized systems interact with EMS and building automation controllers.

Pecan: Compound leaves have 9-17 leaflets. Nuts grow in small clusters. Eat nuts raw or in pies.

Keeping It Inside the UNT Network

- EMS communicates only with trusted systems HVAC, security, digital signage on the internal VLAN. This at the same time highly limits any kind of public access with EMS.
- Data remains secure and reliable since the back-end communications stay within the UNT network, there is no risk of exposing event schedules or building automation controls to external threats.

The Role of VLAN Segmentation in Security and Performance

To maintain security and ensure a strong performance, EMS is isolated on its own Virtual Local Area Network, also known as a VLAN. Some of the benefits from EMS being segmented on its own VLAN are:

- **Security:** EMS handles very critical scheduling and access control data. Keeping it on a separate VLAN prevents unauthorized access and thus keeps this information safe.
- **Performance:** Separating EMS traffic ensures that event scheduling and automation systems run smoothly without interference from general network traffic.
- **Reliability:** VLAN segmentation prevents congestion, ensuring EMS can communicate efficiently with building controllers and digital signage systems.

Controllers and Network Isolation

- EMS communicates with building automation controllers for HVAC, security, and lighting and digital signage systems within the university network.
- No external access: The system is kept inside a secure UNT network, meaning access is only possible when connected to the university network or VPN.
- Prevents unauthorized tampering: By limiting communication only between EMS and controllers, there is no risk of event data becoming or getting compromised, security systems, or other building automation controls.

Conclusion

This strong system integration keeps UNT Union displays secure, efficient, and reliable, enhancing students' and visitors' experience all while optimizing resources.

Hazelnut: Sheathed, nut-like fruits mature by autumn. Remove nuts from husks and eat raw or cooked.

Tracker P:ixels: An Exploration of E-Mail Read Receipts

[Ava McWhorter]

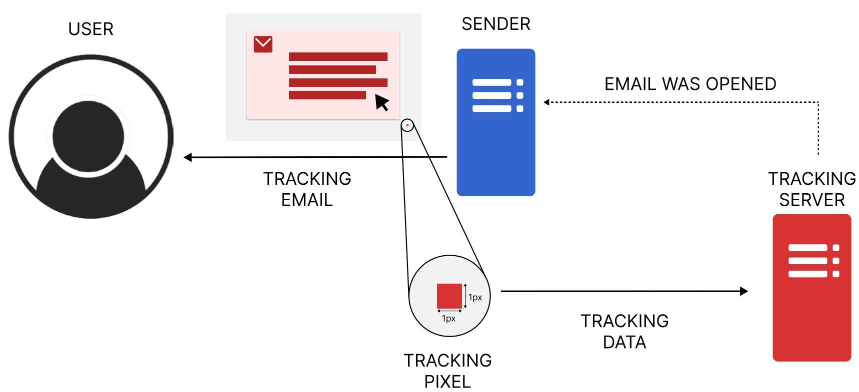
Broadly speaking, I am of the opinion that virtually anything a computer does is worth looking at more closely, because a deeper understanding of the mechanics of the operations of a system can enable you to leverage capabilities outside of the stated design goals of that system. However, I recognize that not everyone has an interest in exploring every little loophole and particularity of the infrastructure upon which they depend to live their day-to-day lives, and so today I would like to talk about one of the more shocking capabilities of a technology critical to our days: tracker pixels in e-mails.

Depending on what you consider e-mail and where you want to start looking, e-mail has been around in one form or another for about 60 years, but for about the first 30 years of its existence (before the late 1990s) it was primarily used for plain text messages. But as computers, expectations, and users got faster, more specific, and less patient, the utility of sending prettier messages over e-mail became apparent, and so standards were developed for the formatting and transmission of web pages as e-mails. This is great for a lot of reasons and a lot of users: now you can nicely typeset, style, and format any message you send, and even embed an image directly in an e-mail!

HTML on its own does nothing; if you send someone an e-mail, it's up to them (or, realistically, a piece of software on their computer) to figure out how to view it, and if they are only looking at the plain text they will only see the plain text. But don't despair, most e-mail clients now include an HTML rendering engine that will ingest the raw data, process it, and display it in your mail client roughly the same as a web browser would that HTML document on the web, allowing your messages to look modern and professional.

However, there is one glaring, massive, nigh-uncorrectable security concern with this infrastructure that your e-mail service might be leveraging already to provide you with read receipts -- regardless of if your recipient knows they're consenting to sending one or not. That security concern is known as a Tracker Pixel.

1. A diagram from wikimedia.org describing how tracking pixels work visually.



How it works is this: Imagine you're running a website for sharing cute cat pictures. You really want to compare the performance analytics of one cat picture to another, but don't feel like doing any work. What you could do, in this case, is configure your website to log whenever a user asks for a specific cat picture, and then when you're ready you can just count the number of entries in the log -- easy analytics! Now, imagine instead of cat pictures for a large audience, you want to track the performance analytics of a single e-mail: you create an invisible 1x1 PNG image instead of a cat picture, add a link to the image in your e-mail, and then check the log in exactly the same way. In essence, you are creating a tripwire on your website that the HTML rendering engine will snag itself on whenever the recipient opens

Sweetgale: Flowers bloom May-June in scaly catkins. Dry leaves and nutlets to use in teas, stews, and sauces.

their e-mail. What's worse, due to the way requesting an image works, unless you take additional security considerations the request from the server will come from YOUR IP address, which is part of the data that is logged.

The easiest way to mitigate this security concern for an end user is to disable fetching remote images when opening e-mails. For obvious reasons, very few people want to do that, and especially given how much the style of modern HTML e-mails depends upon images for headers and footers it leads to a somewhat chaotic experience to do so. The other main way is what Apple has done since about 2021 with Mail Privacy Protection: set up your e-mail server to automatically open every message and download every image when received, so that every e-mail is immediately flagged as read in a false positive.

Ultimately, whether this is significant enough to you to want to mitigate for yourself is entirely subjective and personal, and I certainly will not say unilaterally that people should not load third-party images in e-mail. Tracker pixels have been in use almost as long as HTML email, and a 2021 BBC article estimates their inclusion in nearly two-thirds of even emails that were not flagged as spam -- if this were the hill I chose to die on, I'd have long since fallen. But, broadly speaking, I am of the opinion that virtually anything a computer does is worth looking at more closely, and that a deeper understanding of the mechanics of the operations of a system is critical to examine the ways its capabilities outside of its stated goals can affect a user.

Currant: Low spreading shrubs with smooth branches. Berries are red, black, or golden. Crushed leaves smell like fruits.

A Dive into Emulation

[Alex Dillinger]

What is emulation?
In a nutshell, emulation is the process of mimicking how a computing system works. This can cover a variety of things, such as computing hardware & software to test how they work and run them on unsupported devices, networks to test how applications will work once deployed into a real-world network, and even specific operations like floating-point arithmetic to expand the limited capabilities of a processor. Replication of gaming consoles is probably the most common use of emulation, but as stated earlier, it is not the only use.

Is emulation legal?
The short answer is yes, at least in the United States. As with all things, there are always caveats. Emulation has been deemed legal in the United States, but the distribution of copyrighted materials is not, especially when money exchanges hands. Here are some general guidelines for how to stay out of legal trouble with emulation in the United States:

- Do not pirate, condone piracy, or share methods of pirating of copyrighted material.
- If you are distributing an emulator, remove any copyrighted material such as video game ROMs/ISOs, BIOS/UEFI files, or encryption keys.
- Do not exchange any money for any emulation products without express permission or licensing from the original creator of the emulated system.

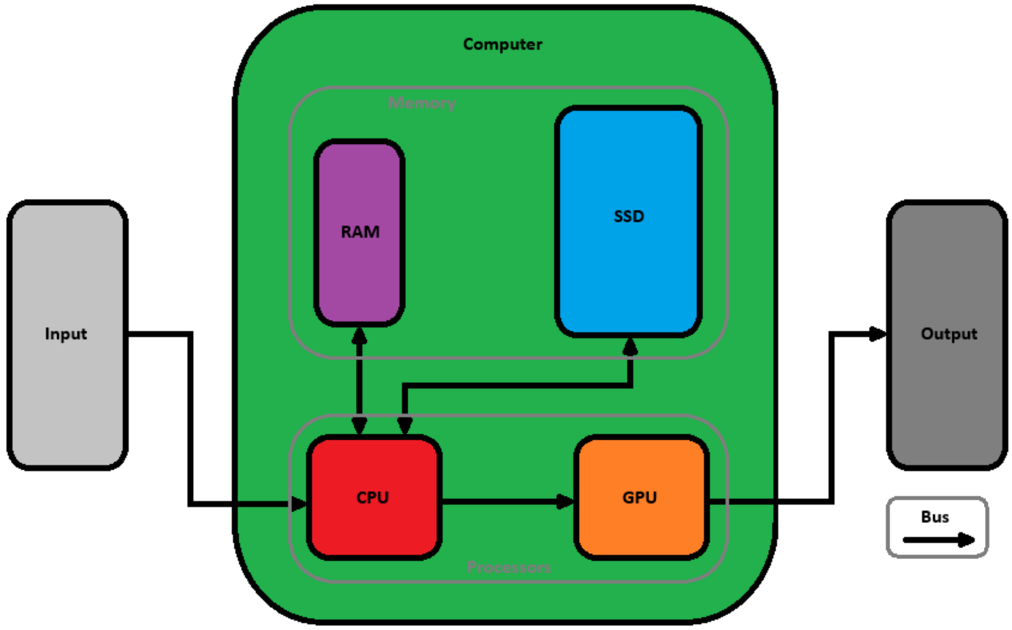
Thimbleberry: Maple like leaves. Produces red berries.

What is needed to create an emulator?
Emulation is a complex process that requires a deep understanding of the hardware and software being emulated, as well as the platforms they operate with. Knowledge of computer architecture and programming languages is often necessary, and, more importantly, documentation for the subject of emulation is paramount. The latter point is where the greatest challenge comes from. Most systems that are emulated use proprietary designs or uncommon hardware causing documentation to be scarce. When documentation is non-existent, an emulation designer will need to reverse engineer the system they are trying to replicate to determine how it works. Now, let's take a quick crash course on the hardware and software architecture of computers.

Crash Course #1: The Hardware Stack
The hardware stack of computers typically contains an array of hardware components arranged around a primary processor that coordinates communications and data processing between each component. While computing systems can vary wildly in terms of what hardware they possess, their components fall into a few of the following categories:

Processor:	CPU, GPU, microcontrollers, FPGA, ASIC, DSP, etc.
Memory:	RAM, HDD, SSD, registers, L-caches, etc.
Interconnect:	Buses, I2C, SPI, UART, GPIO, etc.
Input:	Mouse, keyboard, sensors, microphone, game controller, etc.
Output:	Monitor, speaker, actuator, relay, LED, etc.

A common configuration for personal computers and video game consoles is a system that contains a primary processor as the central processing unit (CPU), a secondary processor for graphics known as a graphical processing unit (GPU – sometimes this is part of the CPU), a faster short-term storage in the form of random access memory (RAM), a slower long-term storage in the form of a hard disk drive (HDD) or a solid state drive (SSD), input devices like a mouse & keyboard or a game controller, and output devices like a TV or monitor and speakers.



Gooseberry: Green berries redden as they mature.

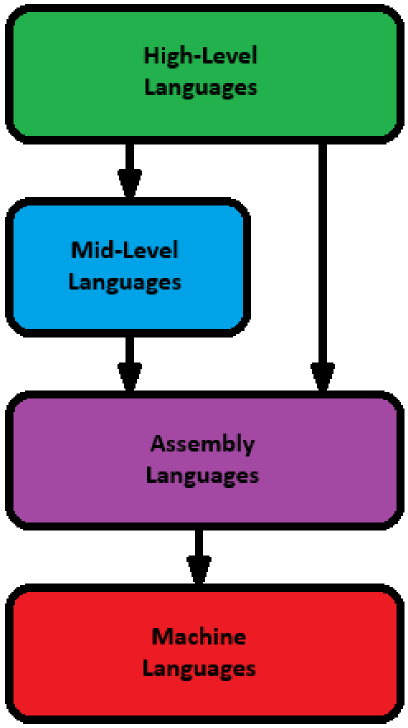
Crash Course #2: The Software Stack

Computers operate on a fundamental level as a series of switches in the form of transistors and signals that are either on (1) or off (0). Data input and output by a computer involves a large combination of these 1s and 0s in specific orders to represent the data flowing through the system. At face value, it would be challenging and time-consuming for someone to do something like typing a paper by entering in the different combinations of 1s and 0s for each letter typed. For reference, a letter/character is typically 1 byte in size, or 8 bits. A single bit is a 1 or 0. To put this into perspective, typing "UNT" would be done by typing "010101010100111001010100" – a unique combination of 24 1s and 0s. That's a bit much.

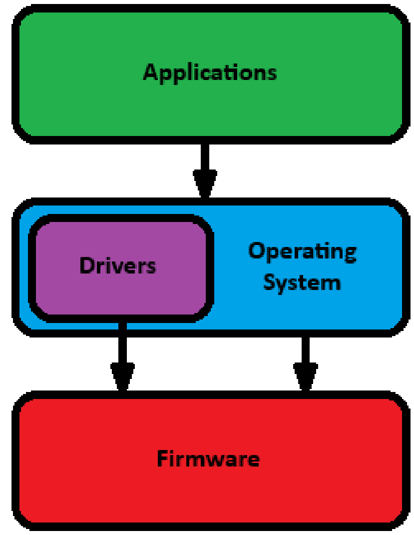
I mention the above to establish a baseline for explaining programming languages and the software stack for computers. A core component of computer science is abstraction, or the hiding of complex details, which is used in computers to simplify the ideas that we want to convey. Abstraction is why the software stack exists.

The following are a few classifications for programming languages:

Machine Languages:	The lowest level of programming languages, this consists of all the 1s and 0s mentioned before representing signals that pass as inputs in the hardware's circuits.
Assembly Languages:	Another low-level programming language that operates just above the machine code, this is the instruction set architecture (ISA) developed by the hardware manufacturer. To run as assembly code, programming languages must go through a compilation process that convert a higher-level language into assembly so that the hardware understands the instructions being sent to it.
Mid-Level Programming Languages:	This is a language like C that operates as both a low-level and a higher-level programming language. It is human-readable, but it is often designed to have each line of code translate into a single line of assembly code, as is the case with C.
High-Level Programming Languages:	This is a language that is human-readable and allows for the implementation of logical instructions telling the computer how to operate. While these sometimes require compilation, such as with C++, these can also be run as scripts through pre-compiled interpreters such as Python or anything built on the .NET framework like Powershell or C#.



Programming Language Stack



Software Stack

The software stack takes advantage of all types of programming languages to build an abstraction platform that is less complex. Software stacks can vary a bit when getting into the realm of containerization and virtual machines (VMs), but for the basic software stack for computers is as follows:

Firmware: This is the lowest layer of the stack utilizing an assembly language developed for the hardware based on its components. It gives higher layers a way to talk to the hardware and tell it what instructions to run. This can come in the form of a BIOS (Basic Input/Output System) for basic I/O operations, a UEFI (Unified Extensible Firmware Interface) for more complex I/O and functionality, or in other forms with additional functionality.

Operating Systems: This is the system that typically lives above the firmware that acts as an interface for humans to use when interacting with the hardware. As far as a user is concerned, this will mostly enable the installation of applications, file management, and interaction with peripheral devices like speakers and displays. The most recognized OSes are Windows and MacOS with Linux appearing more commonly in front of more tech-savvy users.

Drivers: These are the programs that are installed in the OS that tell the OS how to interact with additional features available for the specific hardware the OS is installed on. Without these, the OS might be able to work, but only in a limited capacity using some basic hardware commands based on the hardware detected by it.

Applications: These are the programs that end users directly interact with that control the bulk of the tasks that users perform on computers. These are installed in the OS and thus live at the highest level of the software stack. These are often designed with interfaces that are in human-readable language and use graphics to aid in the usage of any tasks it performs.

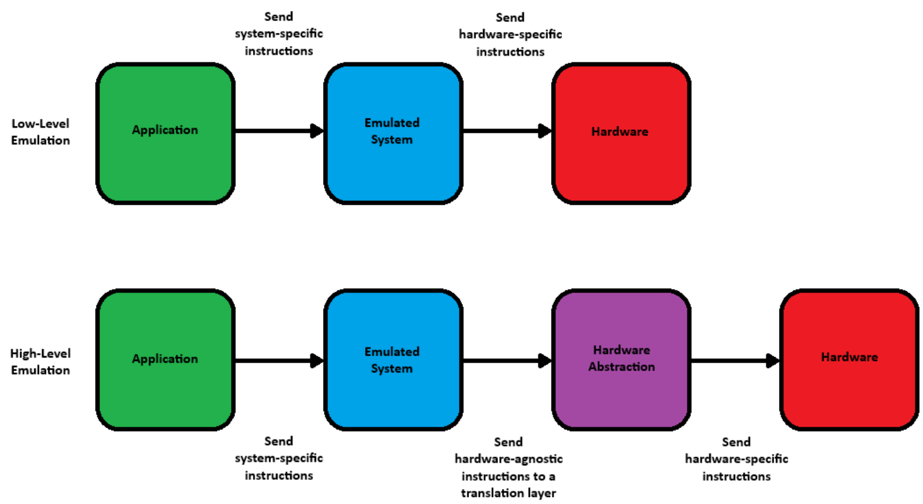
Types of Emulation

Back to emulation! Emulators fall under two main categories: Low-level emulation and high-level emulation.

Juniper: Leaves are needle like and scale line. Bitter, blue berries are edible.

Low-Level Emulation: This is when the hardware components are replicated through simulation as closely as possible, oftentimes even going so far as to replicate each component's signals. This is more commonly used to replicate older computing systems that had less abstraction implemented or in cases where a high degree of accuracy in the emulation is required.

High-Level Emulation: Rather than trying to emulate the structure of the hardware and the signals that flow through it, this is when the general function of the hardware is emulated. This is typically used with newer systems where abstraction layers were put in place to simplify software development for the hardware, or in cases when the emulation can be simplified or optimized by coding out some of the details and using fewer instructions to achieve the same output.



Pawpaw: Large leaves. Oblong fruits that blacken when ripe.

Both types of emulation can be implemented via hardware or software, and each implementation has their merits. For the sake of this article, I will continue by focusing on the software vs. hardware aspect of emulation.

Software

This is where a computer is being replicated purely in software, either by mimicking the individual components of the hardware (low-level emulation), or by mimicking the functionality of the hardware (high-level emulation). The most prevalent traits of software-based emulation are that it is cheaper since you typically don't need specialized hardware to run it and that it is considerably more resource-intensive due to additional processing that is needed to simulate the components and coordinate their instructions accurately. Software-based emulation generally has the following pros & cons:

PROS	CONS
• Cheaper due to a lack of custom hardware. • Hardware agnostic since it only needs an OS to run it. • System snapshots since the entire system's running configuration can be cloned. • Functional extendibility since additional features could be added to the software.	• Requires more powerful hardware compared to the system being emulated. • Inaccuracies can occur due to tricks needed to optimize the synchronization of the hardware and imperfect emulation. • Will often have input latency due to translation layers between the software and the OS.

The biggest issues with software-based emulation involve resource overhead and inaccuracies. Both issues could be drastically lessened with optimization techniques. For instance, resource overhead can be addressed by reducing the number of layers between the emulator and the hardware, such as running the emulator on a device with a lightweight OS and no additional software or in a container in a container engine that runs on bare metal machines. Likewise, emulation inaccuracies could be addressed by taking advantage of multiple processor cores with parallel programming and proper locking of data with semaphores. If optimizations are not implemented, then the quality of emulation could be greatly diminished.

Hardware
This is where a computer is being replicated purely with hardware, either by using similar hardware with a similar instruction set for each component (low-level emulation) or using custom or reconfigurable hardware like an FPGA (Field Programmable Grid Array) to mimic each component (low-level emulation) or the general functionality (high-level emulation) of the system. The most prominent traits of hardware-based emulation are that it tends to deliver a truer experience of the original system, at least when using low-level implementations, it is often faster due to less resource overhead since there are dedicated components to utilize, and it is often more expensive due to the hardware costs. Hardware-based emulation generally has the following pros & cons:

PROS	CONS
• Hardware requirements are at a minimum due to a lack of software translation layers. • Emulation and synchronization are typically more accurate due to having dedicated hardware that can perform instructions simultaneously with other components. • Hardware can be designed to use modern components without sacrificing accuracy. • Will have virtually zero input latency due to direct hardware connections and a lack of translation needed.	• More expensive due to use of custom hardware, especially when emulating more complex systems. • Not easy to repurpose since it will only work to emulate devices that it was designed for unless using reconfigurable hardware like FPGAs. • Subjected to component supply and demand cost and availability fluctuations.

Chokecherry: Cylindrical clusters of spring flowers that are followed by dark, red-purple berries. Edible pea-sized fruit that is extremely tart.

With hardware-based emulation, the largest issues are the cost of development and the ability to repurpose the hardware. While the cost of development is not easily addressed, choosing reconfigurable hardware like FPGAs can give long-term cost savings by improving on the ability to repurpose the hardware. FPGAs work by using look-up tables (LUTs) to imitate the expected output signals of a piece of hardware based on the inputs it is given. With enough LUTs in the FPGA, more complex devices can easily be emulated. They are not cheap devices, but the reconfigurability reduces the long-term costs. Instead of building new hardware to emulate a different system, all you would need to do is synthesize and implement the new hardware configuration on the FPGA, and it would begin to mimic the new configuration.

Hardware vs. Software: Which Is Better?
As with anything in life, this is very subjective and highly affected by the implementation in each medium. Both options have their issues, but most of these issues can be addressed with a variety of optimization techniques. So long as both options are optimized, the typical breakdown is that hardware-based emulation has the potential to give a faster and more accurate experience while software-based emulation has the benefit that it is virtually always cheaper. All in all, do your research, and you will find the option that works best for you.

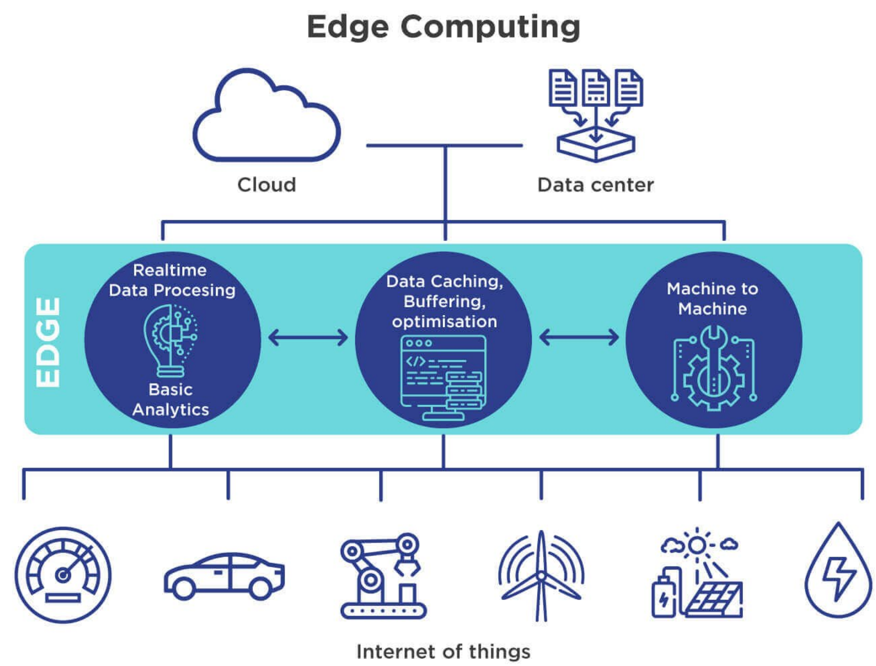
Edge Computing

[Alex Martinez]

Edge computing is a transformative technology that brings computation and data storage closer to the sources of data. This distributed computing model reduces latency and improves efficiency compared to traditional centralized data centers. As the Internet of Things (IoT) and 5G networks continue to expand, edge computing is becoming increasingly vital for processing the vast amounts of data generated by connected devices.

What is Edge Computing?

Edge computing refers to the practice of processing data near the edge of the network, where the data is generated, rather than relying on a centralized cloud or data center. This proximity to data sources allows for faster processing and response times, which is crucial for applications requiring real-time data analysis.



How does it Work?

Edge computing represents the layer where the physical and digital realms meet. This allows devices that are connected to the internet or network to either input or capture data, and where users and applications receive information for insights and decision-making. By processing data at the network's edge, edge computing prevents latency issues, particularly with real-time data, which could affect an application’s performance or intended function.

To establish an edge network, IT teams enhance computing capabilities in remote sites by implementing servers and storage that can efficiently process data for local devices. Alternatively, processing can occur on the memory and storage of edge devices such as laptops, smartphones, and IoT sensors. Rather than routing data produced by edge devices through a central data center or the cloud, an edge network handles and retains most data locally or on proximate edge servers, only transmitting necessary information to the cloud or central data center.

Applications of Edge Computing

Edge computing applications are utilized in a range of industries, taking advantage of localized data processing, reduced latency, and immediate decision-

Crabapple: Alternate leaves are usually toothed. Fragrant pink or white flowers are followed by small, oblong apples.

Bunchberry: Woodland plant with leaves growing as whorls. Tight clusters of red berries and are best cooked.

making capabilities. Below are some significant examples of edge computing applications:

1. *IoT Devices*: Edge computing is integral to the functionality of IoT devices, which generate massive amounts of data. By processing this data locally, edge computing enables real-time analytics and decision-making.

2. *Smart Cities*: In smart cities, edge computing supports various applications such as traffic management, energy distribution, and public safety by providing timely data processing and insights.

3. *Healthcare*: Edge computing can enhance healthcare services by enabling real-time monitoring and analysis of patient data, leading to quicker diagnoses and treatments.

4. *Autonomous vehicles*: Self-driving cars or autonomous vehicles are equipped with numerous IoT sensors that gather vast quantities of data every second. They depend on real-time data processing for immediate reactions and cannot depend on a distant server for quick decision-making.

5. *Energy Grid Optimization*: Energy companies utilize edge computing to gather and save data from oil rigs, gas fields, wind turbines, and solar farms. Operators on rigs frequently implement edge artificial intelligence to identify hazards and enhance the inspection and optimization of their pipelines. Edge computing aids the sector in boosting operational efficiency, ensuring worker safety, and predicting when maintenance tasks should be performed.

6. *Artificial Intelligence (AI)*: Edge computing allows AI and machine learning applications to produce, retrieve, and analyze large amounts of data more quickly and with dependable connectivity.

Key Benefits of Edge Computing

Edge computing is gaining traction as it enables businesses to gather and analyze their raw data more effectively. Organizations increasingly require immediate access to their data to make informed choices regarding their operational efficiency and business processes. When utilized correctly, edge computing can assist organizations in enhancing safety and performance, automating tasks, and improving the user experience.

A few benefits of edge computing are:

1. *Reduced Latency*: By processing data closer to its source, edge computing minimizes the time it takes for data to travel across the network. This is particularly important for applications like autonomous vehicles and industrial automation, where milliseconds can make a significant difference

2. *Improved Bandwidth Efficiency and Cost savings*: Edge computing reduces the amount of data that needs to be transmitted to central servers, alleviating bandwidth constraints and lowering costs.

3. *Increased Productivity*: Organizations enhance their operational efficiency and workforce productivity by swiftly reacting to information. By examining data gathered at the source, companies can identify and enhance the underperforming aspects of their facilities, infrastructure, or equipment. Integrating edge computing with artificial intelligence and machine learning tools enables the extraction of business intelligence and insights that aid employees and organizations in achieving greater productivity.

4. Edge computing frequently occurs in locations with limited internet access. By establishing an edge computing framework, businesses can reliably handle, assess, and archive data. This greatly minimizes the risk of experiencing operational interruptions due to network or connectivity issues.

5. *Personalization*: Each edge server can contain data and processing specific to its location, offering user experiences that can be localized and customized.

Challenges and Future Directions

Despite its advantages, edge computing faces several challenges, including:

1. *Scalability*: Managing and scaling edge infrastructure can be complex and costly

2. *Interoperability*: Ensuring seamless integration between edge devices and existing systems is crucial for widespread adoption.

3. *Security*: While edge computing offers numerous benefits, it also presents unique security challenges. Edge devices are often deployed in less secure environments, making them vulnerable to physical tampering and cyberattacks. Ensuring robust security measures, such as encryption, authentication, and regular updates, is essential to protect data and maintain system integrity.

4. *Limitations on Resources*: Edge devices often have limited computational resources, including processing power, memory, and storage. Optimize edge applications for resource efficiency. Explore advancements in edge hardware to improve the capabilities of devices, allowing for more complex computations at the edge.

Edge Computing vs Cloud Computing

Cloud computing and edge computing are interconnected since they both stem from the principles of distributed computing and aim to make data quickly available to users and applications. Although cloud computing offers strong computational power, extensive storage options, and various services and integrations, edge computing emphasizes reducing both physical and virtual distances between data centers and edge devices, resulting in decreased latency and increased speeds.

Looking ahead, advancements in edge computing technology, coupled with the growth of IoT, 5G networks, and AI integration. These developments will further enhance the capabilities of edge devices, enabling faster and more reliable data processing. As more industries recognize the benefits, the demand for edge computing will continue to grow, driving innovation and transforming industries.

Bearberry: Low-growing evergreen shrub. Eat berries raw or cooked, brew tea with leaves.

Beyond the Hard Drive: Exploring UNT Storage Options

[Ryan Faulder]

Choosing the right storage location is crucial for productivity, collaboration, and data security. AITS provides several options, each with unique strengths. This guide helps you select the best one.

UNT's Storage Options

- **SharePoint:** A web-based platform (integrated with Microsoft 365) that functions like a website for internal teams and departments. Ideal for centralized document management, version control, complex permissions, and team collaboration, SharePoint offers robust management and search features but may be more cumbersome than other options.

- **Shared Drives (Network Drives):** Traditional network drives, like the S:\ drive, accessible on the UNT network. They offer a familiar file/folder structure and are suitable for storing files that need to be accessed by multiple users within a department or team. Access is generally limited to on-campus computers or via VPN. Shared drives provide one week of previous versions for recovery.

- **OneDrive:** Your personal cloud storage within Microsoft 365, linked to your UNT account. Accessible from anywhere with internet connectivity, OneDrive offers automatic syncing, easy file sharing, and version history. It can also sync local folders (like Documents and Desktop) for backup and access.

- **Microsoft Teams:** A collaboration hub combining chat, video conferencing, and file storage. Files in Teams are stored within a dedicated SharePoint site, providing integrated communication and file sharing with version control.

- **Local Storage (Your Device):** The hard drive or SSD inside your computer. This provides the fastest access to your files and works offline, but it doesn't offer built-in backup or collaboration. Consider using local storage for temporary files, huge media files (videos, databases), or when working with applications that require maximum performance. Remember to back up any important data stored locally.

OneDrive, Teams, SharePoint, and Shared Drives all have built-in recovery mechanisms, protecting your data from accidental deletion or corruption.

Head-to-Head Comparisons

Let's look at some common scenarios, providing context to help you choose the best storage option:

- **Scenario 1: Individual work on multiple devices needing access anywhere.**
    - **Best Choice: OneDrive.** OneDrive is designed for individual work files and provides automatic syncing between your devices and the cloud, along with version history for protection.
    - **Avoid:** Local Storage (no automatic backup, not accessible from other devices) and Shared Drives (less convenient for individual use, primarily accessible on-campus).

Squashberry: Rounded leaves have 3 main lobes. Translucent red or orange berries.

- **Scenario 2: Departmental policies, procedures, and templates that require controlled access and versioning.**
    - **Best Choice: SharePoint.** SharePoint is purpose-built for departmental document management. Its permissions system lets you control who can view and edit files, and version control ensures everyone uses the correct document.
    - **Avoid:** Shared Drives (fewer collaboration and management features compared to SharePoint) and OneDrive (designed for individual files, not shared departmental resources).
- **Scenario 3: Collaborative research paper with a small group, requiring frequent edits, feedback, and co-authoring.**
    - **Best Choice: Teams.** If your collaboration group already uses Teams for communication, storing documents within the Team keeps everything integrated and easily accessible.
    - **Avoid:** OneDrive (while file sharing is possible, it's less efficient for ongoing group collaboration than Teams, and files are tied to an individual's account, posing a risk of deletion if that user leaves the university). Shared Drives (simultaneous editing can lead to file conflicts and version control issues).
- **Scenario 4: Very large video file that needs quick access from an on-campus workstation.**
    - **Best Choice: Local Storage or Shared Drive.** For very large files, local storage usually provides the best performance. If other on-campus users need access, using the Shared Drive is a good alternative, though speeds may be reduced compared to local storage.
    - **Avoid:** OneDrive or SharePoint (while capable of handling large files, uploading and downloading may be slow depending on network conditions).
- **Scenario 5: Archiving old project files that are rarely accessed but must be retained for compliance.**
    - **Best Choice: Shared Drive.** Shared Drives are a good option for long-term archiving, especially for files that need to be accessible from on-campus computers.
    - **Avoid:** Local Storage (not suitable for long-term archiving due to the risk of data loss) and SharePoint/Teams (best used for active collaboration; archiving can clutter the workspace).

Sharing in Office 365 Apps

Sharing a document from Word, Excel, or PowerPoint usually stores it in *your* OneDrive; you're granting access, not moving the file. This enables co-authoring and version control.

Third-Party Storage Platforms

Storing UNT data on third-party services like Google Drive and Dropbox is **prohibited** due to security and compliance concerns. UNT provides robust, secure, and cost-effective storage solutions (OneDrive, SharePoint, Shared Drives) that meet the needs of faculty and staff. The use of external services, which often duplicate these existing resources, is generally not permitted.

Wild Rose: Flowers succeeded by fruits called hips that re rich in vitamin C. Leaves, flowers, and hips are good in drinks and foods.

Star Trek Replicators Are Cool! Can They Go From Science Fiction To Science Fact?

[Jock Mund]

The sci-fi TV show Star Trek introduced a variety of futuristic technologies, many of which have inspired real-world innovations including voice activated assistants, touchscreen interfaces and wearable technology, to name a few. One of the more interesting technologies that always seems to spark fascination is the replicator: a device capable of instantly materializing objects, food, and materials from pure energy. While this technology makes compelling science fiction, significant scientific and engineering challenges suggest that Star Trek-style replicators may remain firmly in the realm of fantasy rather than becoming technological reality in the foreseeable future.

Star Trek replicators function by rearranging subatomic particles to create matter in any form desired. They convert energy into matter following Einstein's famous equation $E=mc^2$, creating everything from hot Earl Grey tea to complex machine parts. The implications of such a device are enormous. If humanity could develop a replicator, it would revolutionize economies by eliminating scarcity, reducing waste, and providing instant access to goods. Hunger, material shortages, and supply chain issues would become obsolete. However, the feasibility of this technology in the real world is highly questionable due to numerous scientific and logistical challenges, not to mention the ethical concerns and implications.

Ground Cherry: dark-cenered flowers followed by sweet, edible yellow berries that grown in lantern-like husks.

The Challenges of Replicator Technology

1. The Laws of Physics and Matter-Energy Conversion

One of the biggest barriers to replicator technology is the requirement to convert energy into matter. Converting even a small amount of matter into energy requires an enormous energy input. In Star Trek, replicators seemingly create objects out of pure energy, however in reality this would be extremely inefficient and practically impossible with current technology.

Currently, our best method for converting energy into matter involves high-energy particle collisions, such as those performed at CERN's Large Hadron Collider. Even then, these reactions produce only subatomic particles, not usable molecules or complex structures. Without a fundamental breakthrough in physics, a replicator capable of converting energy into fully formed objects remains a distant dream.

2. The Challenge of Atomic and Molecular Precision

Even if we could harness the energy required, assembling molecules with absolute precision presents another major obstacle. While 3D printing and nanotechnology have made significant progress in material assembly, we still lack the ability to arrange atoms at will to create complex materials with the same efficiency as a replicator.

Modern synthetic biology and molecular manufacturing are advancing toward precise control of chemical structures, but they are far from being able to create diverse materials on demand. Biological processes, such as DNA replication and protein folding, provide templates for molecular assembly, but replicating these mechanisms artificially is extraordinarily complex.

Additionally, the replication of food and organic substances is another challenge. While lab-grown meat and artificial flavors exist, fully constructing a steak or a cup of coffee from individual molecules—while ensuring taste, texture, and nutritional value—is far beyond our capabilities.

3. Energy and Resource Limitations

Even if we assume that precise molecular assembly becomes possible, the energy costs of running a replicator would be astronomical. In Star Trek, energy is supplied by advanced fusion reactors or antimatter power sources, but in the real world, we are still heavily reliant on fossil fuels and nuclear energy, both of which have limits.

A real replicator would require:
• **Massive amounts of energy** to break down and reassemble matter.
• **A continuous supply of raw materials** to rearrange into new objects (unless it operates purely on energy-to-matter conversion, which is even less feasible).
• **Advanced computational systems** capable of storing and executing molecular blueprints for any requested object.

Given these constraints, developing a replicator-like system would require monumental advances in energy production, computational power, and material science.

4. Ethical and Economic Implications

Beyond the scientific challenges, the introduction of a replicator would create profound societal and ethical dilemmas. If people could freely create anything, economies based on scarcity and production would collapse. Industries like agriculture, manufacturing, and retail would become obsolete, leading to economic upheaval and widespread job loss.

Additionally, the potential for misuse is enormous. If a replicator could create anything, it could just as easily produce weapons or dangerous substances. This raises concerns about security, regulation, and potential restrictions on the use of such technology.

Potential Alternatives and Future Technologies

While full Star Trek-style replicators remain science fiction, several technologies are progressing in related directions:
• **3D Printing:** Modern 3D printers can create objects from plastic, metal, and even biological materials. While limited to specific materials and requiring pre-existing resources, this technology represents a primitive form of replication.
• **Nanotechnology:** Scientists are exploring molecular manufacturing techniques that could lead to advanced material assembly at the atomic level.
• **AI-Driven Material Synthesis:** AI models are being used to predict and create new chemical compounds, which may eventually allow for more complex automated material fabrication.
• **Bioprinting:** Advances in medical science are allowing for the printing of tissues and organs, which could one day lead to fully synthetic food or medical supplies.

Although none of these are true replicators, they demonstrate that aspects of the concept are slowly becoming reality in specific fields.

In conclusion, the Star Trek replicator remains one of the most intriguing technological concepts in science fiction, but its realization is hindered by significant scientific, energy, and economic challenges. While modern advancements in additive manufacturing, nanotechnology, and synthetic biology are making strides toward similar goals, the idea of instant matter-energy conversion currently remains beyond our reach. Even if the science could be solved, ethical and societal implications would need to be carefully managed. For now, replicators remain firmly in the realm of fiction so I wouldn't let your Earl Grey tea get cold waiting for it.

Flatwoods Plum: Sour, purple-black fruits have yellow flesh and have single flat pit.

Y2K24: The Day Our Screens Turned Blue

[Michael Hamilton]

If you were out and about on July 19, 2024 you may have noticed that all of the Windows machines around you were an unpleasant blue. That Friday morning, over 8.5 million Windows systems failed and displayed the infamous blue screen of death (BSOD) due to a faulty update to American cybersecurity firm CrowdStrike's Falcon security software. An event, that some say realized the fears surrounding Y2K.

At 04:09 UTC, CrowdStrike distributed the faulty configuration update, which passed validation due to a bug in CrowdStrike's content verification system, that resulted in a read-out-of-bounds memory safety error. This happens when a program tries to read beyond what its set scope is and reads adjacent memory. The error triggered an invalid page fault and caused machines to boot into the BSOD. CrowdStrike reverted the update at 05:27 UTC and a fix was deployed at 09:45 UTC but for most systems, the damage had already been done.

Machines could be restored by rebooting while connected to the network, giving the opportunity to download the fix from CrowdStrike, however, if crashes continued, a tech was required to be in person to remove the faulty file, Channel File 291. If you were on campus that day, you probably saw IT teams out in full force to fixing devices, likely with faces that mimicked the one on the BSOD itself. While we managed to get most of our important systems back online that Friday at UNT, the issue was much more widespread for larger organizations and services.

Although the estimated 8.5 million Windows devices only make up less than 1% of Microsoft's global Windows install base, the systems that were impacted were running critical operations. The outage disrupted businesses, airports, train stations, banks, broadcasters, governments, and insurers estimate the outage will cost U.S. Fortune 500 companies $5.4 billion. Delta Air Lines reported a $500 million loss due to about 7,000 flight cancellations that occurred over a five-day period during peak summer vacation season as a result of the outage.

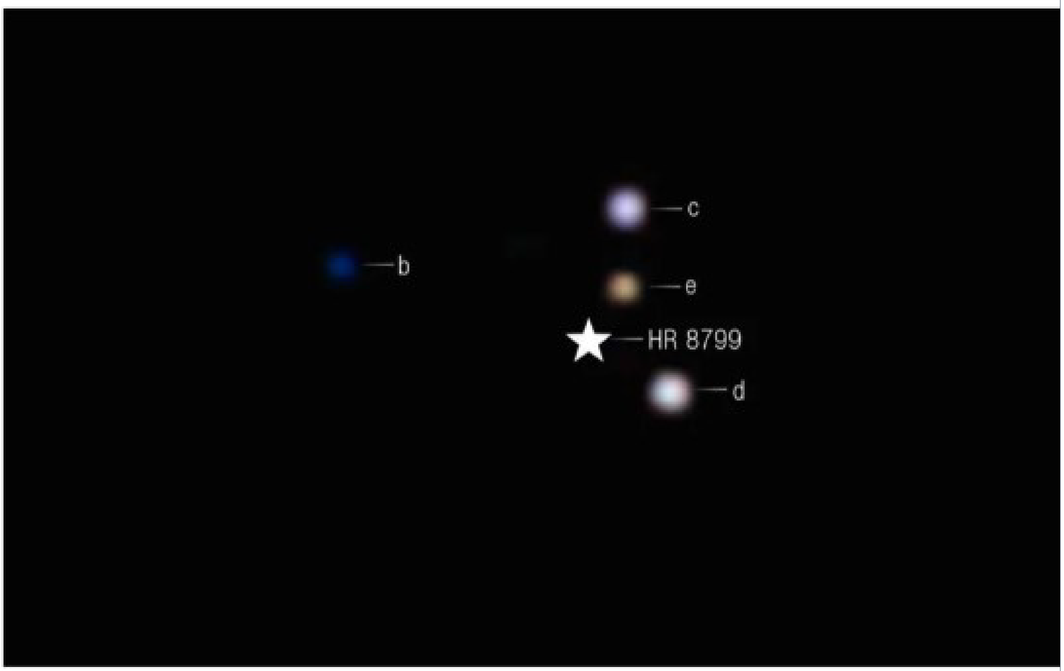
Businesses worldwide were reminded that day about the importance of robust backup and disaster recovery plans along with a strong, onsite team of technicians able to implement them. We at UNT were able to resolve the issue quickly on campus because of our skilled IT staff, who were prompt in finding and implement a solution, minimizing downtime for our systems and showcasing the importance of our team.

Sea Grape: Not real grapes but the cluster of fruits are edible.

Blurry Beginnings: From Our Solar System to Distant Worlds

[Josh Huckabee]

With the release of the James Webb Space Telescope's (JWST) recent images of distant gas giants focused on the HR 8799 system, we're reminded of how far space exploration has come. These alien planets, orbiting their star 130 light-years away, appear blurry despite the most advanced technology ever created. While the resolution is impressive, it's still limited by the vast expanse between us and these distant worlds. However, this is far from the first-time humanity has had to deal with blurry images in space exploration.



The clearest look in the infrared yet at the iconic multi-planet system HR 8799. (Image credit: NAS
CSA, STScI, W. Balmer (JHU), L. Pueyo (STScI), M. Perrin (STScI))

When the first spacecraft ventured into our solar system in the 1960s, the images they captured of planets like Venus and Jupiter were much less clear. The technology available at the time was rudimentary by today's standards. The first successful images of Jupiter, for example, were sent back by the Pioneer 10 spacecraft in 1973. These pictures were grainy, pixelated, and nothing like the crisp images of Jupiter we see today. Even the Voyager missions in the 1970s provided stunning images, but their low resolution was a far cry from modern expectations.

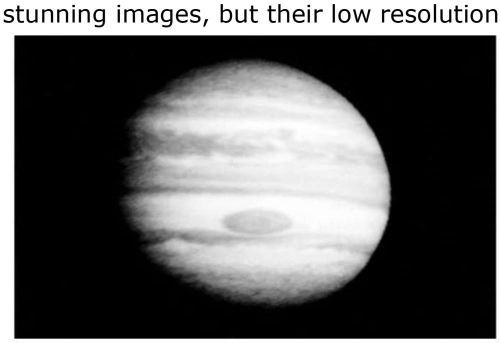


Image: NASA

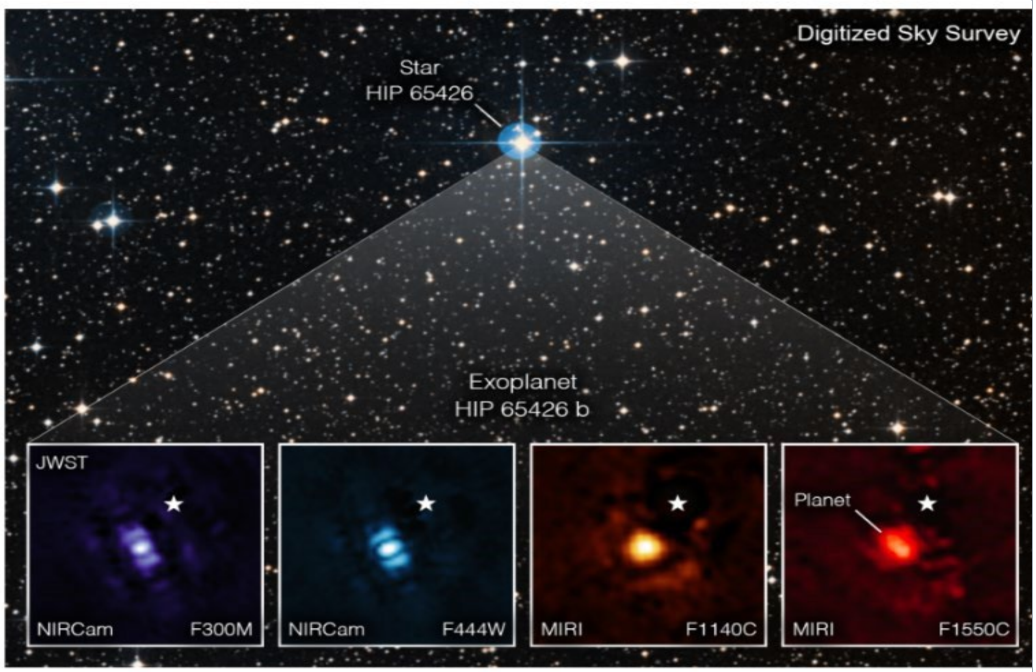
Image: NASA/JPL-Caltech/SwRI/MSSS/Kevin M. Gill

What has changed in the years since? Computing advancements have played a crucial role in improving how we capture and process space images. In the early days, spacecraft had limited processing power, and data had to be transmitted over long distances at slow speeds. Scientists had to manually enhance and piece

Buckeye: Pinkish flowers bloom in erect clusters. Large seeds have a light eye spot. All parts of the plat are toxic.

together blurry images, often using massive computers that could barely compare to today's smartphones. Fast forward to today, and we have supercomputers capable of processing terabytes of data, allowing us to interpret and enhance even the faintest signals from distant stars and planets.

The James Webb Space Telescope (JWST) represents a monumental leap in space imaging, equipped with an array of advanced infrared sensors that allow it to observe distant exoplanets, stars, and galaxies with remarkable precision. One of its key capabilities is capturing images of exoplanets using a technique known as coronagraphy, which blocks out the light of a star to reveal the much dimmer light from surrounding planets. Despite these technological advancements, the immense distances involved, hundreds of light-years away, continue to present significant challenges in achieving high-resolution imagery. The gas giants recently imaged by JWST appear blurry because even the most advanced sensors struggle with isolating such distant, small objects from the overwhelming brightness of their parent stars.



Webb NIRCam and MIRI coronagraphic images of the exoplanet HIP 65426 b. The white star symbol marks the location of the star blocked out by the coronagraphs. The exoplanet does not display Webb's hallmark six-spiked diffraction pattern due to the pupil plane coronagraph masks. Credit: NASA/ESA/CSA, A Carter (UCSC), the ERS 1386 team, and A. Pagan (STScI). Download the full image here.

Vetch: Climbing or sprawling plant that has bluish, pea-shaped flowers. Poisonous plant.

Additionally, the resolution limitations faced by JWST highlight the ongoing challenges in space exploration. While modern telescopes like JWST employ sophisticated adaptive optics to correct for atmospheric distortions and interferometry (the technique of analyzing wave interference patterns to improve resolution) to combine signals from multiple telescopes, these techniques still have their limits when observing objects that are not only distant but moving at high velocities relative to Earth. The image clarity that we take for granted within our own solar system is difficult to replicate for planets orbiting stars light-years away. The role of computational power in interpreting these blurry images cannot be overstated. By utilizing cutting-edge algorithms and high-performance computing, JWST's data undergoes intricate processing that reconstructs and enhances the images, unveiling previously hidden details. These advanced data models are essential for improving the signal-to-noise ratio and identifying subtle features in the data. Ultimately, the fuzzy images of distant gas giants stand as a powerful reminder of the challenges involved in space imaging, while also showcasing the remarkable progress achieved through advancements in hardware, data processing, and computational techniques.

Looking ahead, space imaging will only continue to improve. As quantum computing and AI technologies evolve, we may soon be able to process and interpret space data in ways that were once unimaginable. What was once blurry and distant may soon become clearer, bringing us closer to understanding the mysteries of the universe. Imagine what we might see in 20 years' time.

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Cabbage Palm: Leaf blades are up to 7 feet long. Leaf producing edible bud of young plants are like cabbage. Harvesting the bud will kill the plant.

Do you wanna hang?

[Michael Garcia]

Your PC high, where air flows free?
Dangling parts in perfect dance,
A cooling dream, a work of chance.

Cases trap the heat inside,
Fans may whirr, but temps still ride.
Gravity calls, let metal swing,
Suspended high—no throttling.

Cable mess? A simple thread.
Save the cash, no frame to dread.
No cluttered desk, no wasted space,
Just floating power, pure embrace.

At first, you laughed, you shook your head,
“I don’t get it?”—so you said.
But logic grows, the doubt thins out,
Efficiency leaves room for doubt.

So now that you have re-read this and are convinced,
You now realize you don’t wanna hang—**but need to hang.**

Alaria: Seashore plant – edible raw blades that can be cooked like spinach.

PC cases are overrated. It’s really just a metal box that does nothing for you but trap heat, collect dust along with pet hair, and ultimately limits your airflow creating a space heater in your room; the Texas summer is coming too... You may invest in fancy fans, dual tower heat sinks, or some liquid cooling custom loop just to mitigate the problem caused by the case itself, but really you just wanted the loop because it was cool. But why encase something that generates heat? You have taken physics; you know heat is bad for those electronics.

What’s the most effective way to cool something? Maximum surface area, unrestricted airflow, and zero obstructions. What obstructs airflow? *The case.* What generates hot spots? *The case.* What’s the common denominator in every overheating problem? *The case.*

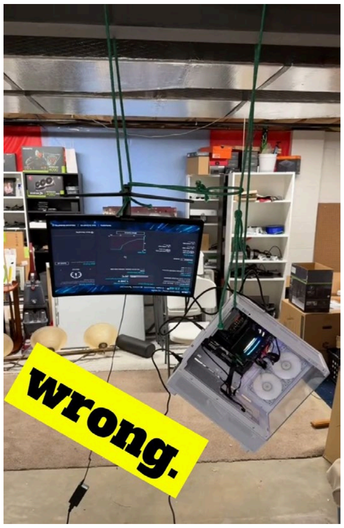
A high-performance GPU, like a 3080 suffocating inside a standard case, hitting 80-90°C, suddenly breathes easier in a hanging setup, dropping to 70-80°C(!!!) thanks to unrestricted airflow. The CPU is also trapped under a panel and relying on forced ventilation will peak at 80-95°C, but free it from its enclosure, and it comfortably settles around 65-75°C. Remove the walls and your hardware runs cooler, more efficiently, and without the struggle of fighting its own recycled heat.

How to do it:

If done correctly, your PC won’t break your ceiling, but that’s also dependent on your ceiling. Start by removing the case, get all those components out, but save the screws. String wise its really up to you, you could use strong fishing line, zip ties, or sturdy thread to suspend each part securely, but make sure its *real sturdy* because recently released parts are kinda heavy. The motherboard can be supported by threading the line through its mounting holes which will ensure its stable but not under stress. The GPU can hang from its bracket holes, positioned at a slight angle for both aesthetics and function, if you have a PCI riser make sure the cable isn't bending too much. The power supply may need the screws part way in so you can tie the strings around them. Your drives are lightweight and easy to suspend, while cables should be given enough slack to prevent strain, consider leaving the screws in as well to tie around. With everything neatly in place and if your ceiling still holds, you'll have saved your PC from cooking, consider the following examples:

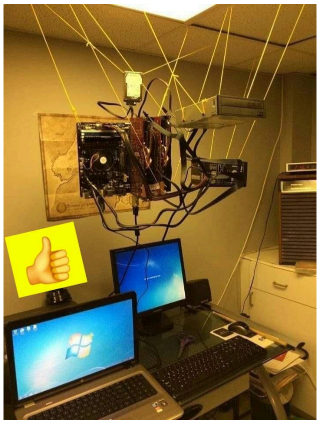
Example A: *Wrong*

It's ok but there's still a case, the knots look cool though.



Example B: *Correct*

Now this is a masterpiece of physics and anti-compliance of societal norms! Every component, perfectly suspended, free from any restrictive cases and stagnant airflow. The motherboard floats like it were always meant to, the GPU hangs with confidence, and the PSU a suspended powerhouse, effortlessly feeding the system from its rightful place because it's cool. No clutter, no heat pockets, only unfiltered cooling efficiency. This proves that the best way to build a PC isn't under your desk in a case—its in the air ,hanging.



Sea Lettuce: Edible raw or wash and boil.

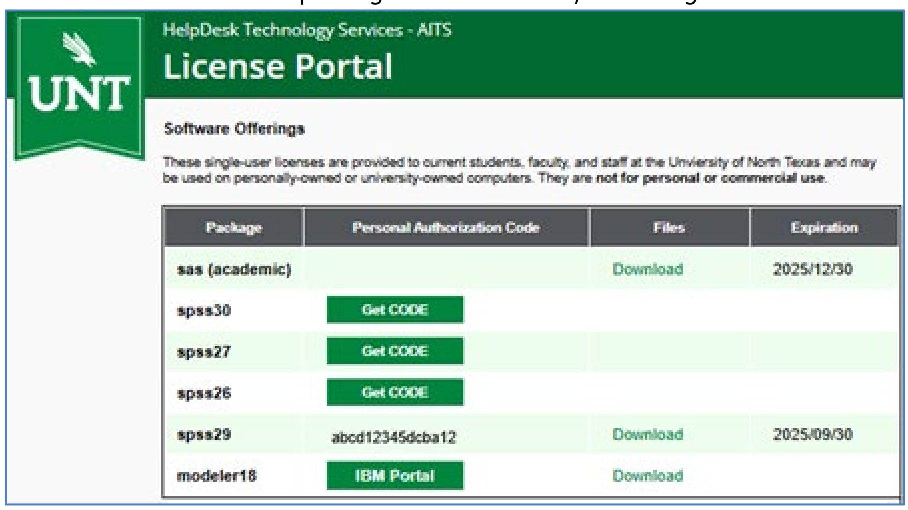
Statistical Software Licenses for Home-Use

[Richard Sanzone]

AITS manages several statistical software licenses available for home-use on personal or off-campus UNT-owned devices. These home-use licenses are not intended for on-campus UNT-owned machines - software installations for on-campus UNT-owned machines should be handled through UNT Department IT Support.

LicensePortal

The LicensePortal is available at https://licenseportal.unt.edu/ and can be accessed with the standard UNT EUID and password. Several software licenses and installation packages are available, including:


UNT

HelpDesk Technology Services - AITS

License Portal

Software Offerings

These single-user licenses are provided to current students, faculty, and staff at the University of North Texas and may be used on personally-owned or university-owned computers. They are **not for personal or commercial use.**

Package	Personal Authorization Code	Files	Expiration
sas (academic)		Download	2025/12/30
spss30	Get CODE		
spss27	Get CODE		
spss26	Get CODE		
spss29	abcd12345dcba12	Download	2025/09/30
modeler18	IBM Portal	Download	

- **SAS**. "**S**tatistical **A**nalysis **S**ystem," is a comprehensive software suite used for advanced analytics, data management, business intelligence, and predictive modeling, providing complex statistical analysis, data mining, and report generation through both a graphical interface and a programming language.

- **SPSS**. "**S**tatistical **P**ackage for the **S**ocial **S**ciences", is a software program that analyzes and manages data. SPSS is used in many disciplines, including social science research, business, healthcare, and government. Multiple versions are available through the LicensePortal.

- **Modeler**. SPSS Modeler is a data mining and text analytics software application from IBM. It is used to build predictive **model**s and conduct analytical tasks. Modeler has a visual interface which allows users to leverage statistical and data mining algorithms without programming.

AITS Website

The software section of the AITS HelpDesk website has information and resources about many software packages, including several statistical applications. See the "STATISTICS SOFTWARE" section at https://aits.unt.edu/software/downloads.html .

- **MATLAB.** MATLAB is a programming language and numeric computing environment used by researchers, engineers, and scientists. It is used for data analysis, signal processing, control systems, and more.

Bull Kelp: Long blades, up to 65 feet long radiate from a single float.

- **SIMULINK.** Simulink is a MATLAB add-on product with a user-friendly, graphical interface used for simulation programming and modelling.

- **Mathematica.** Mathematica is a high-powered software program for mathematical computation that can be used in many scientific and engineering fields.

MyLab Virtual Software
Remote access to a large number of software applications is provided by the UNT online virtual lab powered by Citrix. See https://aits.unt.edu/software/downloads.html for more information on statistical applications available in MyLab.

- **STATA** is a statistical software package used to analyze, manage, and visualize data.

- **LISREL** ("**LI**near **S**tructural **REL**ations") is a statistical software package that analyzes structural equation models.

- **EViews** is a statistical package that specializes in data analysis and forecasting.

- **NVivo** is a software application used for qualitative and mixed-methods analysis of unstructured text, audio, video, and image data.

- **RStudio** is an integrated development environment for **R**, a programming language for statistical computing and graphics.

For more information on what software packages are available, who can use the software, and usage restrictions, please see the software detail table at https://aits.unt.edu/software/ .

Penny Cress: Herb has lance shaped leaces. Flat fruits are notched at the tip. When cooking leaves, change the water twice.

Exploring the Past: My Trip to the Video Game History Museum

[Christopher Horiates]

In the realm of digital entertainment, few things capture the imagination like video games. These interactive experiences have evolved dramatically over the decades, and to understand this evolution, I embarked on a trip to the Video Game History Museum. Located in Frisco, Texas, the museum is a treasure trove of nostalgia, innovation, and cultural milestones.

Upon entering the museum, I was greeted by an exhibit showcasing the pioneering days of video gaming. The early arcade games, with their pixelated graphics and simple yet addictive gameplay, set the stage for the industry. The exhibit featured classics like "Pong," "Space Invaders," and "Pac-Man," each representing a significant leap in technology and design. It was awe-inspiring to see the original cabinets and consoles, which were the genesis of what has become a multi-billion-dollar industry.

One of the most captivating sections of the museum focused on the rise of home consoles. The transition from arcade machines to home entertainment systems marked a pivotal moment in gaming history. Exhibits highlighted consoles like the Atari 2600, the Nintendo Entertainment System (NES), and the Sega Genesis. Each console had its own unique story and influence on the gaming landscape. The NES, for example, played a crucial role in reviving the video game industry after the crash of 1983. Seeing these consoles and their iconic games brought back memories of childhood afternoons spent in front of the television, controller in hand.

Northern Bedstraw: Leaves grow in whorls of 4 arpund the stem. Small clusters of while flowers bloom in the summer.

As I ventured further into the museum, I encountered exhibits dedicated to the evolution of graphics and gameplay. The advancements in technology were evident as I moved from the 8-bit and 16-bit eras to the 3D and HD generations. The museum showcased games like "Super Mario 64," which revolutionized 3D platforming, and "The Legend of Zelda: Ocarina of Time," which set new standards for adventure games. The transition to high-definition graphics was marked by titles like "Halo" and "Uncharted," which demonstrated the potential for cinematic storytelling in video games.

Another significant aspect of video game history is the advent of online gaming. The museum's exhibits on this topic were particularly intriguing. From the early days of dial-up connections and LAN parties to the modern era of massive multiplayer online games (MMOs) and esports, online gaming has transformed the way we play and interact. Games like "World of Warcraft" and "Fortnite" have created virtual communities where players from around the world can collaborate and compete. The museum highlighted the technological advancements and cultural shifts that have made online gaming a cornerstone of the industry.

The museum's efforts to preserve video game history were evident in their meticulous curation of artifacts and exhibits. From rare prototypes and development kits to original artwork and promotional materials, the museum offers a comprehensive look at the industry's heritage. Interactive displays allowed visitors to experience classic games and see the evolution of gameplay mechanics firsthand. The preservation of these artifacts ensures that future generations can appreciate the rich history of video games and the impact they have had on culture and society.

My trip to the Video Game History Museum was not just an educational experience; it was a journey through my own personal history with video games. Seeing the games I played as a child, teenager, and adult brought back a flood of memories. The museum's exhibits reminded me of the countless hours spent exploring virtual worlds, solving puzzles, and competing with friends. Consoles like the Atari 2600, NES, Sega Genesis, Super Nintendo, PlayStation, Xbox, PC and Nintendo 64 were all part of my gaming experience. It was a poignant reminder of how video games have shaped my life and the lives of millions of others.

The Video Game History Museum is more than just a collection of artifacts; it is a celebration of the creativity, innovation, and cultural significance of video games. My trip to the museum was an enlightening and emotional journey through the past, present, and future of gaming. The exhibits offered a comprehensive look at the industry's evolution, from its humble beginnings to its current status as a global phenomenon. As I left the museum, I felt a deep appreciation for the history of video games and the people who have contributed to their creation. This trip was a reminder of the power of interactive entertainment and its ability to connect, inspire, and entertain. The best part about this was sharing it with my family. My wife and I looked back at our past and our 9- and 7-year-old were oh so frustrated with the games and controllers. It was great to show them how we used to play video games.

While there, they had a TI99-4A. My dad worked at Texas Instruments in the 80s. The kid on top is me from 1986, and my son below is playing on the same computer I had as a kid almost 40 years ago. I was using computers at a very young age and the rest is history……

Prickly Lettuce: Prickly scalloped leaves are lance shaped. Eat the leaves raw or cooked. Older leaves are bitter and should be cooked with 2 changes of water.

Understanding HIPAA: What is Covered and What is Not

[Jonathan Hons]

The Health Insurance Portability and Accountability Act (HIPAA) is a critical piece of legislation designed to protect the privacy and security of individuals' health information. Understanding what is covered under HIPAA and what is not can help both healthcare providers and patients navigate the complexities of health information privacy.

What is Covered Under HIPAA?

HIPAA applies to specific entities and types of information. The entities covered under HIPAA are known as "covered entities" and "business associates."

Covered Entities

Covered entities include:

1. **Healthcare Providers**: This category encompasses a wide range of providers, including doctors, clinics, hospitals, psychologists, dentists, chiropractors, nursing homes, and pharmacies. These providers must comply with HIPAA if they transmit any health information electronically in connection with transactions for which the Department of Health and Human Services (HHS) has adopted standards.

2. **Health Plans**: Health plans include health insurance companies, health maintenance organizations (HMOs), company health plans, and government programs that pay for healthcare, such as Medicare, Medicaid, and military and veterans' health programs.

3. **Healthcare Clearinghouses**: These entities process nonstandard health information they receive from another entity into a standard format or vice versa. They act as intermediaries between healthcare providers and health plans.

Business Associates

Business associates are individuals or entities that perform certain functions or activities on behalf of, or provide certain services to, a covered entity that involve the use or disclosure of protected health information (PHI). Examples include billing companies, transcription services, and cloud storage providers.

What Information is Covered?
HIPAA protects "protected health information" (PHI), which includes any individually identifiable health information that is transmitted or maintained in any form or medium. PHI encompasses a wide range of information, such as:

- Medical records and histories
- Test results
- Treatment information
- Prescription information
- Billing information

What is Not Covered Under HIPAA?

While HIPAA provides robust protections for health information, there are certain entities and types of information that are not covered by HIPAA.

Pickrelweed: Aquatic plant that has a dense spike or blue flowers. Eat young leafstalks in salads.

Non-Covered Entities

Non-covered entities are organizations or individuals that do not fall under the definition of a covered entity or business associate. Examples of non-covered entities include:

1. **Health and Fitness Apps**: Many consumer-facing health and fitness apps, such as those that track exercise or diet, are not covered by HIPAA. These apps are typically regulated by state laws or the Federal Trade Commission (FTC) rather than HIPAA.
2. **Wearable Devices**: Devices like fitness trackers and smartwatches that collect health-related data are generally not covered by HIPAA unless a covered entity or business associate uses them in a manner that involves PHI.
3. **Personal Health Record (PHR) Vendors**: Companies that offer personal health record services directly to consumers without involving a covered entity are not subject to HIPAA regulations.
4. **Employers**: Employers are not covered entities under HIPAA when they handle health information as part of employment records. However, if an employer operates a self-insured health plan, that plan is a covered entity.

Information Not Covered

Certain types of health-related information are not considered PHI under HIPAA and, therefore, are not protected by its regulations. These include:

- **De-identified Information**: Information that has been stripped of all identifiers that could link it to an individual is not considered PHI and is not covered by HIPAA.
- **Employment Records**: Health information maintained by an employer in its role as an employer is not covered by HIPAA.
- **Education Records**: Health information included in education records covered by the Family Educational Rights and Privacy Act (FERPA) is not subject to HIPAA.

Conclusion

HIPAA plays a crucial role in safeguarding the privacy and security of health information. By understanding what is covered under HIPAA and what is not, individuals and organizations can better protect sensitive health information and ensure compliance with the law. While HIPAA covers a broad range of entities and information, it is important to recognize the limitations and areas where additional protections may be needed.

Buffaloberry: Branches and leaves has a silvery hue. Sour red berries form a soapy froth when rubbed together.

Solution to last newsletter's brainteaser

Counting for all of us is about as natural as breathing, I am sure you will agree!

When visiting my local zoo recently I counted 90 legs and 38 heads. With this information, how many birds (two-legged) and how many mammals (four-legged) creatures did I see?

Answer – 4 legs = 7

2 legs = 31