

Digital Technology Merit Badge Troop 1214 – April 2020

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Digital Technology – Binary at its core

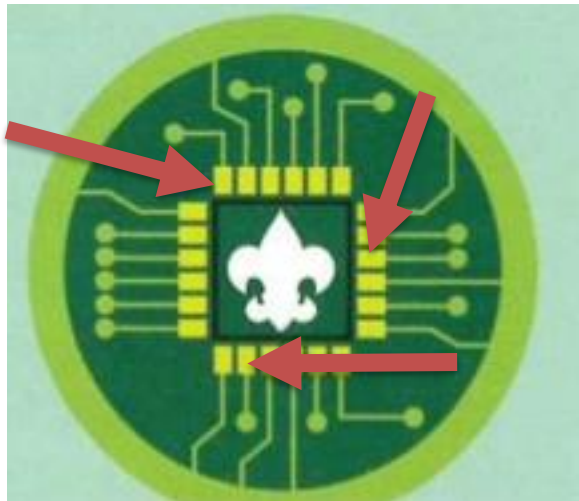
- **Binary is a designation of “two numbers”:** Bi-nary
- **0 and 1 are the basis of computer language, essentially off and on**
- **Computers interpret and translate complex binary strings into meaningful code, letters and numbers.**
 - ASCII is the term referring to recognizable characters such as numbers, letters & symbols (A 5 #). These characters are equal to Binary groups of eight 1s and 0s per character
 - A in Binary is 010000001
 - 5 in Binary is 00110101
 - # in Binary is 00100011

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Digital Technology – Binary in a Badge

The original design for the Digital Technology merit badge contained a special ASCII encoding in Binary. However, due to constraints in the badge making process the idea was abandoned in the final design.



- 01000010 = B
- 01010011 = S
- 01000001 = A

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Digital Technology over time

- Your Grandparents Time (~1940s-1970s)



1970s: IBM Mainframes

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Digital Technology over time

- Your Parents Time (~1980s-2000)



1991 – 2009 The Philips CD-i 100 “Internet”
 1985: The first still video cassette system
 1990: First HD TV Broadcast

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Digital Technology over time

- Your Time (~2000s-Present)

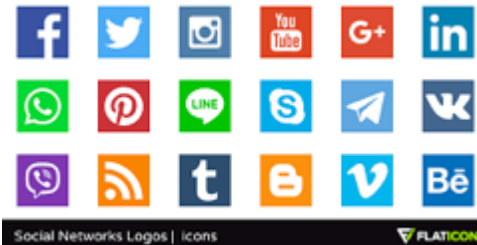
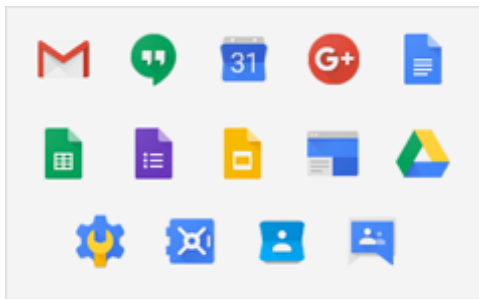


**Growth of Digital Storage Availability
Cellphone to Smartphone Revolution**

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Digital Technology over time

- Your Time (~2000s-Present)



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Digital Technology over time

- The Future????

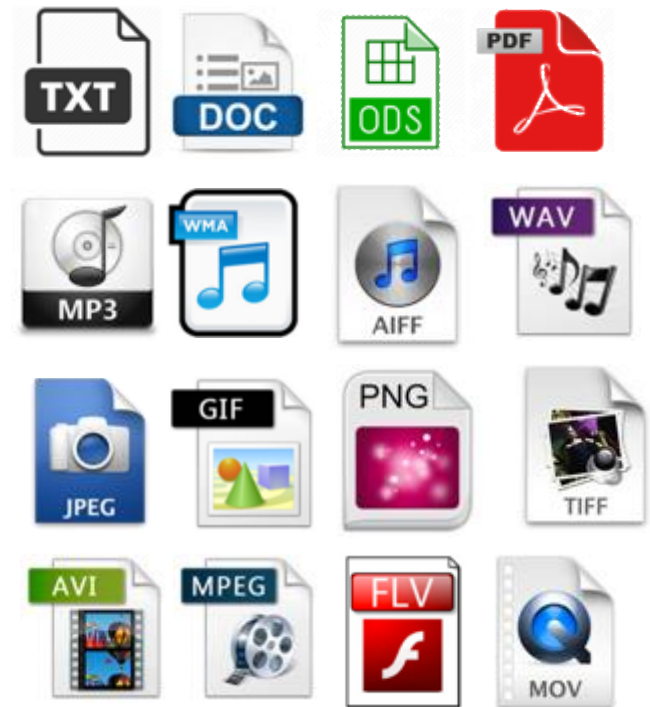


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Digital Technology – Digital Files

For digital storage, different types of data are digitized into different formats.

- **Text is digitized as ASCII**
 - Digital Formats: txt, doc, ods, pdf
- **Sound is digitized as waves forms**
 - Digital Formats: mp3, wma, aiff, wav
- **Pictures are digitized as pixel patterns**
 - Digital Formats: jpg, gif, png, tiff
- **Videos are digitized as frames and rates**
 - Digital Formats: avi, mpeg, flv, mov

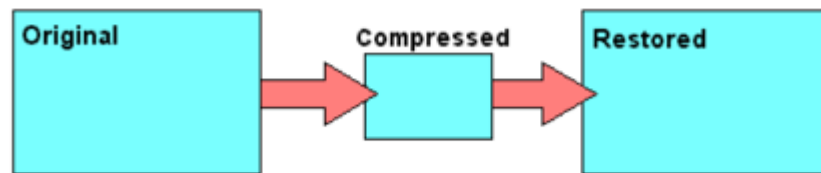


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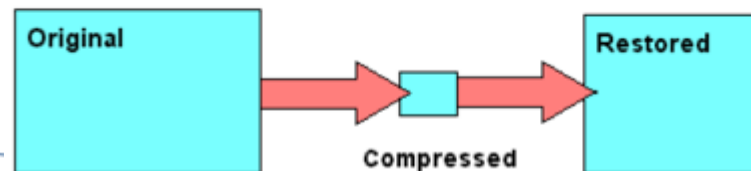
Digital Technology – Lossy vs Lossless

- Compression works on the principle of removing extraneous data to reduce the size of a digital file
- **Lossy** means some of the original quality is removed to reduce the size. Cannot be restored. Examples: JPG, GIF, MP3
- **Lossless** (“no Loss”) allows the “original” quality of the object to remain. Examples: WMA, PNG, WebP

LOSSLESS



LOSSY



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Digital Technology – Programming

- Many devices can be made “better” with digital programming



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Digital Technology

Computers, Gaming Consoles & Mobile Devices



Similarities:

Processors
Sound
Display

Programs
Install Software
Internet Access

Connectivity
Digital Storage
Audio Input (Most)

Differences:

Keyboard
Multi-user
Expansion

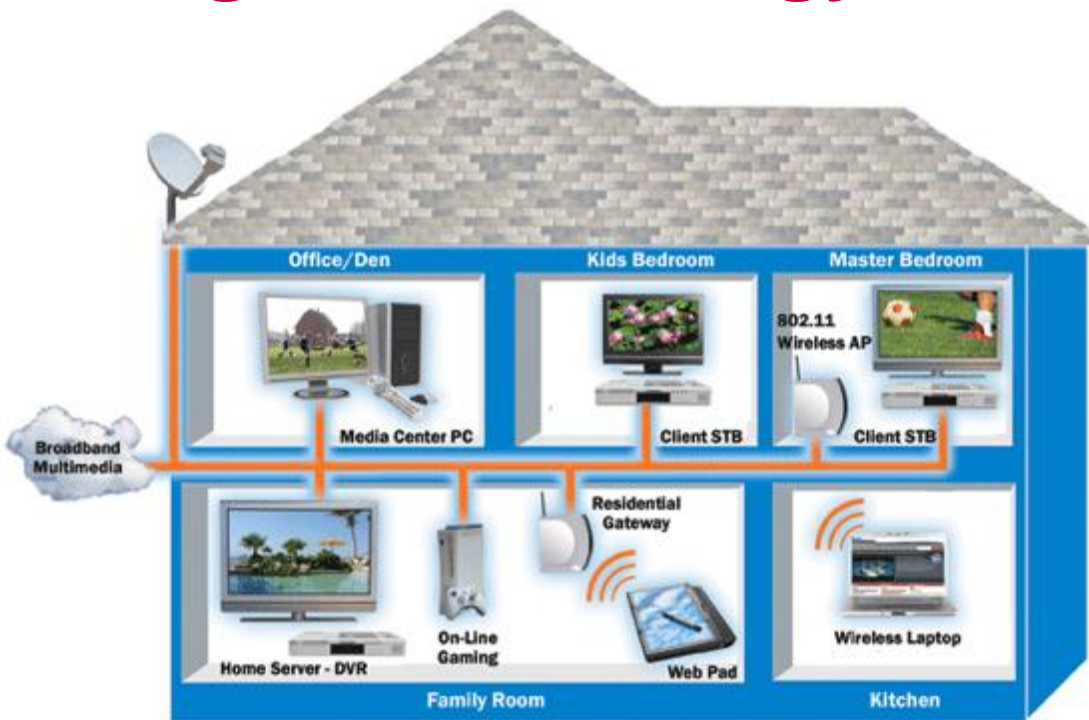
Portable
Cellular
Restricted Apps

Controllers
Proprietary Media
Online platforms



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Digital Technology – Computer Networks

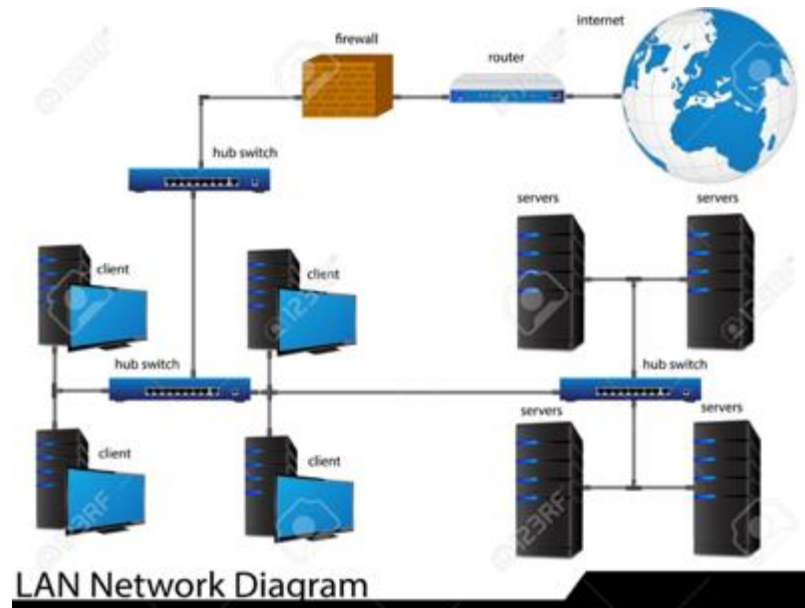


- **Home Network**
 - Computers
 - Wireless Network
 - Gaming Systems
 - TV Systems
 - Mobile Devices
 - Internet

A computer network is a group of computer systems and network devices interconnected to allow access to shared resources, such as printers and the Internet.

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Digital Technology – Computer Networks



- **Business Network**

- Computers
- Servers
- Hubs
- Firewall
- Router
- Internet

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Software, Programs and Apps

Series of commands or set of instructions for a processor to complete a task:

- Word Processing
- Games
- Utilities (calendar, calculator)
- Photo/Video Editor



ComputerHope.com



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Software, Programs and Apps

Software, programs and Apps are created by developers using specific code or script.

Examples of coding or programming languages are:



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Software, Programs and Apps

Apps you & your family use?

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Digital Technology – Malware

- **Malicious code in the form of:**

- Viruses
- Worms
- Trojan horses
- Spyware
- Adware
- Scareware
- Ransomware



- **Any software used to disrupt computer operation, gather sensitive information, or gain access to private computer systems**
- **Defined by its malicious intent, acting for the interests of the malware owner, rather than the user**

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Protecting Against Malware

- Anti-Virus Programs
- Anti-Malware Programs
- Software and System Updates
- Smart Internet Browsing



System Updates



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What is “the Internet”?

- Global Interconnection of networks
- Supports transmission of data in multitudes of formats
- Supports the “World Wide Web”
- Works on a principal of routing requests and responses



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Connecting to the Internet

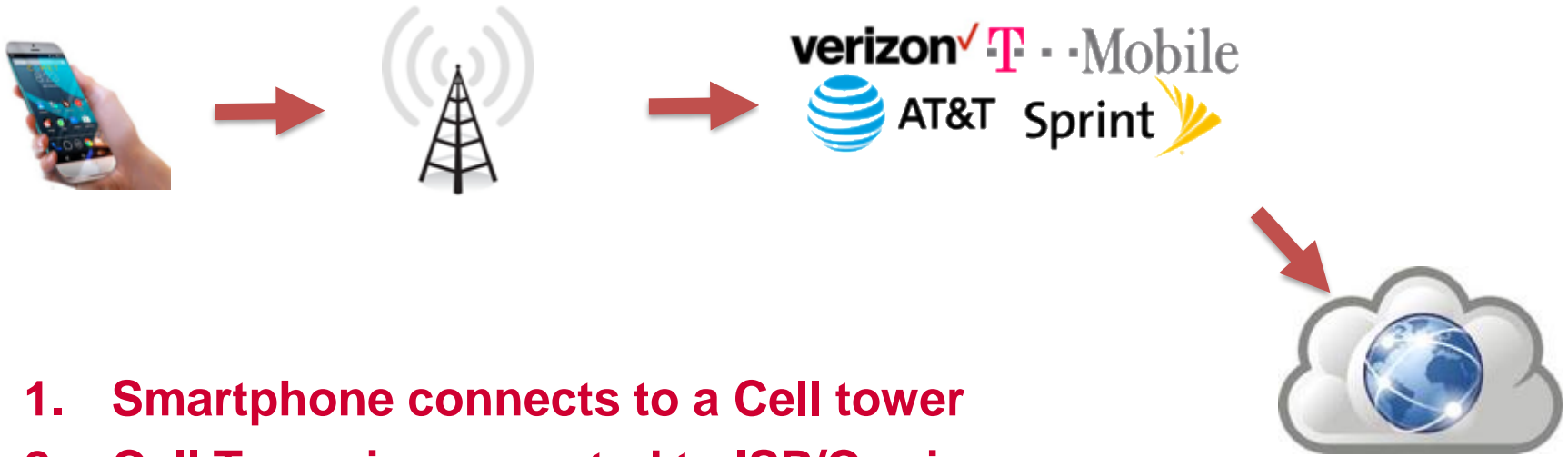


1. Tablet obtains IP address from WiFi Router
2. WiFi Router is connected to Cable Modem
3. Cable Modem is connected to ISP
4. ISP routes traffic to and from the Internet

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Digital Technology

Connecting to the Internet



1. Smartphone connects to a Cell tower
2. Cell Tower is connected to ISP/Carrier
3. ISP routes traffic to and from the Internet

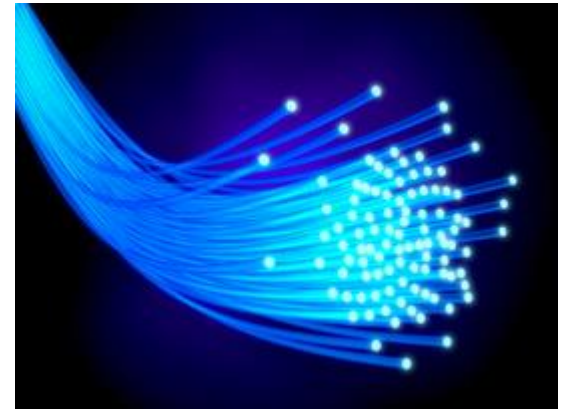
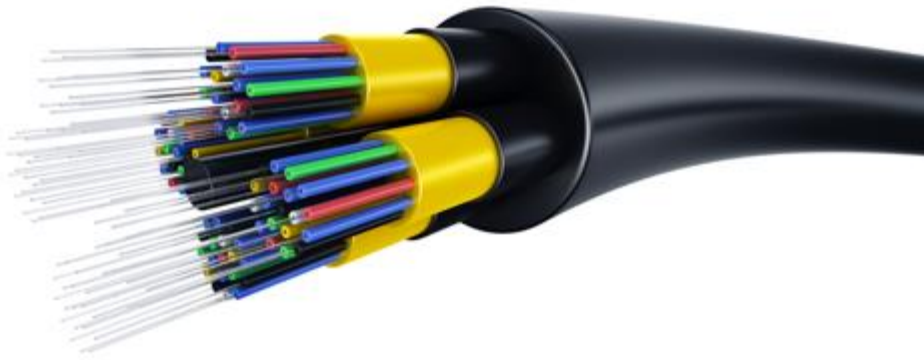
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The Internet Fiber Backbone

Optical cable and optical devices make today's internet work. Lasers and optical cable transmit data in a series of flashes, where on and off signify Binary data streams like Morse code on a telegraph line.



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Searching the Internet

As early as 1990 search engines have enabled computer users to search for information on the WWW

Early Search Engines:

- Archie (First!)
- Webcrawler
- Infoseek
- Altavista
- Lycos
- AskJeeves

How do they work?

- Automated programs called Bots crawl websites and record what they find
- Bots will follow links between websites to find more content
- Systems review the “found” content and identify important words creating an “index”
- When you search the engine looks up matches in the index and provides links to the content it knows about.

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Searching the Internet

Early and modern search engines enable powerful search capabilities by using logic:

Examples:

1. Campfire program - Match anything with campfire or program
2. Campfire +program - Matches those with both words only
3. “Campfire program” - Matches only when those words appear exactly
4. Campfire program –girlscouts - Matches both words withOUT “girlscouts”

Other powerful capabilities are to search for video, image and shopping results



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HTTPS – Secure Browsing

HTTPS is the secured “protocol” used to protect web browsing content on the internet.

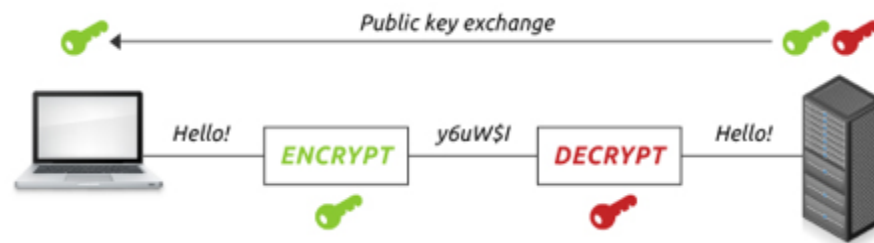
Principles of HTTPS:

1. Uses encryption between the sender and receiver
2. Allows for the sender to “verify” the receiver before sending sensitive data
3. Supports ability to ensure data wasn’t tampered with

Symmetric Cryptography



Asymmetric Cryptography



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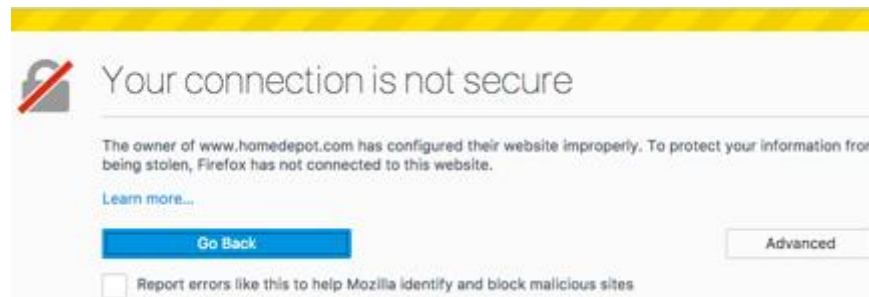
HTTPS – Secure Browsing

Modern internet browsing uses an extensive process to try and protect internet users through HTTPS.

When visiting a site over HTTPS browsers will display a lock icon or say “Secure”



This means that the browser has checked the certificate of the website and has completed a secure connection using HTTPS and the websites certificate. Modern internet browsers will also warn you if there is an issue with a certificate





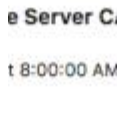
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HTTPS – Secure Browsing

Website certificates help browsers identify and validate secure websites.

 <p>*.www.yahoo.com Issued by: DigiCert SHA2 H Expires: Monday, March 19, 2018 at 8:00:00 AM Eastern Daylight Time This certificate is valid</p> <p>▼ Details</p> <p>Subject Name Country US State/Province CA Locality Sunnyvale Organization Yahoo! Inc. Common Name *.www.yahoo.com</p> <p>Issuer Name Country US Organization DigiCert Inc Organizational Unit www.digicert.com Common Name DigiCert SHA2 High Assurance EV Root CA</p> <p>Serial Number 0C 8A FC 0D Version 3 Signature Algorithm SHA-256 with RSA Encryption Parameters none</p> <p>Not Valid Before Tuesday, Sep 18, 2018 at 8:00:00 AM Eastern Daylight Time Not Valid After Monday, Mar 19, 2018 at 8:00:00 AM Eastern Daylight Time</p>	 <p>DigiCert High Assurance EV Root CA Root certificate authority Expires: Sunday, November 9, 2031 at 7:00:00 PM Eastern Standard Time This certificate is valid</p> <p>▼ Details</p> <p>Subject Name Country US Organization DigiCert Inc Organizational Unit www.digicert.com Common Name DigiCert High Assurance EV Root CA</p> <p>Issuer Name Country US Organization DigiCert Inc Organizational Unit www.digicert.com Common Name DigiCert High Assurance EV Root CA</p> <p>Serial Number 02 AC 5C 26 6A 0B 40 9B 8F 0B 79 F2 AE 46 25 77 Version 3 Signature Algorithm SHA-1 with RSA Encryption (1.2.840.113549.1.1.5) Parameters none</p> <p>Not Valid Before Thursday, November 9, 2006 at 7:00:00 PM Eastern Standard Time Not Valid After Sunday, November 9, 2031 at 7:00:00 PM Eastern Standard Time</p>	 <p>DigiCert High Assurance EV Root CA Root certificate authority Expires: Sunday, November 9, 2031 at 7:00:00 PM Eastern Standard Time This certificate is valid</p> <p>▼ Details</p> <p>Subject Name Country US Organization DigiCert Inc Organizational Unit www.digicert.com Common Name DigiCert High Assurance EV Root CA</p> <p>Issuer Name Country US Organization DigiCert Inc Organizational Unit www.digicert.com Common Name DigiCert High Assurance EV Root CA</p> <p>Serial Number 02 AC 5C 26 6A 0B 40 9B 8F 0B 79 F2 AE 46 25 77 Version 3 Signature Algorithm SHA-1 with RSA Encryption (1.2.840.113549.1.1.5) Parameters none</p> <p>Not Valid Before Thursday, November 9, 2006 at 7:00:00 PM Eastern Standard Time Not Valid After Sunday, November 9, 2031 at 7:00:00 PM Eastern Standard Time</p>
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Copyrights

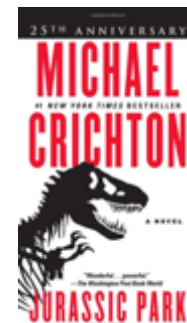
A Copyright is a legal right created by the law of a country, that grants the creator of an original work exclusive rights to its use and distribution, usually for a limited time, with the intention of enabling the creator to receive compensation for their intellectual effort.

What they do

Provides legal protection for the use and distribution of an original work

Why they exist

Encourages original work to be created with the intent it is protected and can be profitable to the creator



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Digital Technology Patents

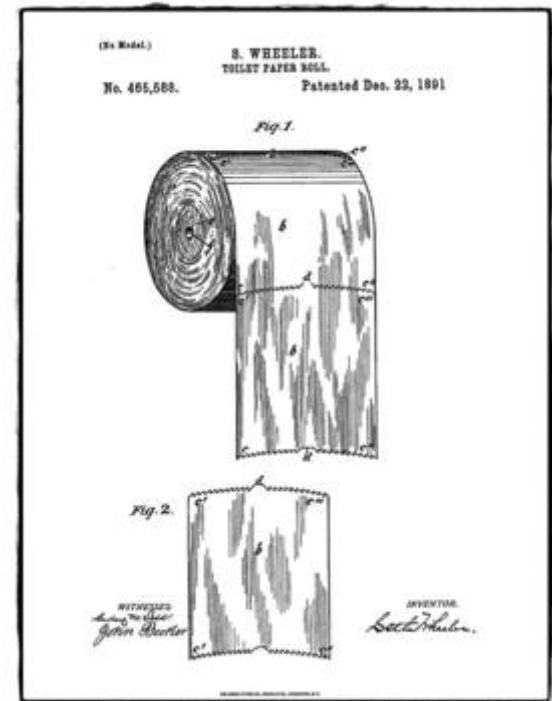
A Patent is a set of exclusive rights granted by a sovereign state to an inventor or assignee for a limited period of time in exchange for detailed public disclosure of an invention.

What they do

Provides protection to the inventor of a solution product or process as the owner

Why they exist

Identifies ownership of a solution, product or process while publicly recording the solution.



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Trademarks

A Trademark is a recognizable sign, design or expression which identifies products, services or a company from those of others. Trademark owners can be individuals, business organizations or any legal entity. Trademarks can be located on packaging, labels, print media or even verbal phrases.

What they do

Provides protection of a unique design or expression to its creator or owner

Why they exist

Protects the owner from misuse or impersonation and creates an identity



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Trade Secrets

A Trade Secret is an invented formula, practice, process, design, instrument, pattern, commercial method or compilation of information which is not generally known or reasonably ascertained by others, and by which a business can obtain an economic advantage over competitors or customers.

What they do

Legally recognizes unique solutions as the property of the developer

Why they exist

Protects the solutions and methods of a developer from being forcibly divulged while keeping products unique and safe.



Google
Algorithm



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Sharing Software with a friend?

Software can be protected by copyright, trademark and patent laws. The defining difference in the software world is how the software is “Licensed”.

You can freely share software with your friend if it is Open Source licensed software.

Open source means that software is made available, including its source code, for distribution or modification.



Linux™



Java™



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Open Source vs. Proprietary

Open Source software can often be as capable, or more capable than proprietary software. Here are some examples of proprietary software and open source alternatives:

Proprietary



Windows



Adobe
Dreamweaver CC

Open Source



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Trademark and Intellectual Property in the News

Investors in a company named IJR applied for a trademark for a new restaurant. The trademark was for “Krusty Krab”



Viacom, owner of the SpongeBob brand, argued that while it did not have a trademark on “Krusty Krab” it was too distinctively tied to its intellectual property to be trademarked by IJR.

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Digital Technology

Proper Disposal

Electronic devices are a complex mixture of many different materials. A single smartphone contains between 500 and 1,000 components. Many of these contain toxic heavy metals as well as hazardous chemicals and materials which do not decay.

Proper disposal of electronics protects the environment, humans and wildlife from exposure to dangerous and toxic materials that are in digital technology devices.



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Digital Technology

Proper Disposal

Some dangerous chemicals used in electronic devices include:

- **Brominated Flame Retardants** – used in circuit boards and casings. Long term exposure can lead to impaired learning and memory functions. It can also interfere with thyroid and estrogen hormone systems
- **Lead** – Used in cathode ray tubes (CTR) in monitors. Exposure can cause intellectual impairment, and damage nervous, blood and reproductive systems.
- **Mercury** – Used in lighting for flat screen displays. Can damage the brain and nervous system especially during early development
- **Hexavalent Chromium compounds** – Used in metal housing production. Highly toxic and carcinogenic to humans and animals.
- **Polyvinyl Chloride (PVC)** – Used in wire and cable insulation. Releases highly persistent and toxic fumes when burned.

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Digital Technology Local Disposal Options

Some local business support recycling of digital technology devices and batteries:



Turtle Wings is an R2 certified recycler of electronics:

To earn an R2 certification you must follow these steps:

1. **Able to determine if technology can be reused or recycled**
2. **Able to test equipment prior to reuse**
3. **Able to repair equipment for reuse or resale**
4. **Able to separated non-reusable items into components**
 1. Steel, copper, aluminum, glass, plastic
 2. Circuit boards, memory chips, power supplies
5. **Able to reprocess components for remanufacturing**
 1. Reprocess components internally
 2. Transfer components to reprocessors



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Homework to complete the Merit Badge

Should already be completed:

- 1 – Show your counselor your current, up-to-date Cyber Chip. (Email SM)
- 4b – Name four apps or programs you or your family use. Describe how you each helps you or your family.
- 5b – Print ideas on how to conduct a Troop Court of Honor or Campfire Program from 3 different websites. Explain how you searched for them on the internet

Complete these over the next 2-3 weeks and bring in to Troop Meetings to confirm

- 6
 - Do 3 of 6a – 6h: Recommend b,c,d,e, or f. Email it to the Counselors
- 9a or 9b
 - 9a. Research 3 careers in Digital Technology, choose one and find out education, training and experience requirements. Explain why it interests you (**BEST CHOICE DUE TO COVID-19 RESTRICTIONS**)
 - 9b. Visit a business or facility that uses digital technology. Describe four ways digital technology is in use. Share what you learned.

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