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Newsletter of the Potomac Area Technology and Computer Society

Mid-August, 2022 Page 1

My turn.....

WOW….can you believe it? I can't. If you go by the typical definition, another six weeks and summer's over! ☹

At the end of June, my wife retired. Off we went to Brooklyn to help take care of grandkids while one of their parents was away. Last week we went to and just came home from three nights in Pittsburgh with friends. I've "driven by" Pittsburgh on my way to the Midwest many times. But this was the first time I've ever "stopped in". I was very impressed. Pittsburgh sits at the confluence of the Allegheny and Monongahela Rivers, which form the mighty Ohio. Pittsburgh was a very dirty town when the mills were running. I know that in the past 40 years or so, they've been cleaning it up. Whomever "they" are, they've done a helluva good job. It's one of the cleanest places I've been. The steel mills and supporting infrastructure are all gone—at least to my unknowing eye. The air is clean, and I hope the rivers are too. There are tall buildings, which remind me of New York City, without the population density 😊. The general pace of life seems slower there. It's more like a Midwest city than an East Coast city. The town, at least the central area between the two rivers is eminently walkable, and there are lots of photo opportunities. 😊

Pittsburgh has 2 incline railways. The Duquesne and The Monongahela. I took this 9-vertical-image panorama from the top of the **Duquesne Incline**:

©Henry S. Winokur Camera; Canon R5, 1/500s, f/11, ISO 400, Lens: RF 14-35 f/4 L IS USM, 35mm

Next printed issue: end of September 2022

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Intro To IP Addresses And Port Numbers

By John Krout, Potomac Area Technology and Computer Society (www.patacs.org)

The foundation for any app or device that communicates with other computers is an IP address and port number. Learn how that works.

Introduction

These days, much of what we all use computers to do is based on communication with other computers through a network. Email, web browsing, and streaming video are three examples.

All of that communication is based on **Internet Protocol (IP) addresses**, and a related concept called **port numbers**. This article will explain those concepts and how the device which provides your home Wi-Fi, called a **router**, plays a critical role in digital network communication.

The USPS analogy

Every computer, smartphone, and tablet (hereafter referred to as "device") has an IP address when connected to a network. Delivery services such as the US Postal Service can deliver mail and packages because packages are labeled with a street address. The IP address assigned to your device serves the same purpose: digital info for your device is delivered fast and

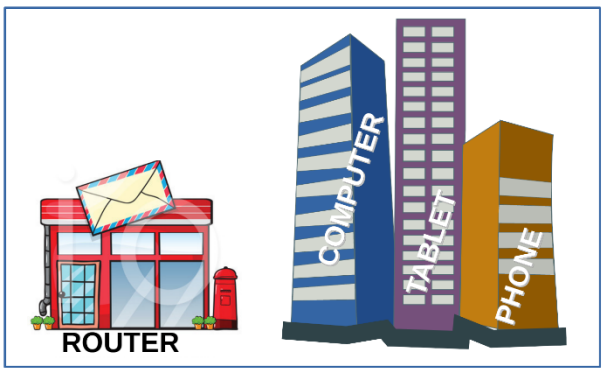

Illustration 1

accurately because it is labeled with your device's IP address. Your router automatically assigns the IP addresses on your network; you don't need to put in a request. Think of your router as your local post office, and each of your devices as a building served by that particular post office, as depicted in **illustration 1** (previous page).

One difference between the USPS and your network is that your device has to ***ask*** for digital info. You use an email application or a web page to request email, and then the new emails are delivered to your device from a computer acting as an *email* server.

Domain Name Service or System (DNS)

Another external server, called a **Domain Name Server** (DNS), helps in a big way: it converts the domain portion of the recipient address, such as **@yahoo.com** or **@nasa.gov**, to an equivalent **IP address**. Using that **IP address**, other computers can relay your request to the destination, and send the reply to your device. You need to know only the name, ***and not the IP address***, of the server you contact. Over time, the destination **IP address** for a familiar domain name might change, but the information on the DNS stays up to date and allows you to use a familiar domain name instead of a changed **IP address**.

What does an IP address look like?

Inside your device, all data are numeric. A byte is simply a number with a collective value in the range of 0 to 255. Combining bytes in creative ways lets us write emails, take and share photos, display web pages, and so forth.

Likewise, an **IP address** is a number, composed of four bytes. An **IP address** is expressed like this: **192.168.1.42**. Each byte in the address is separated from the next by a period.

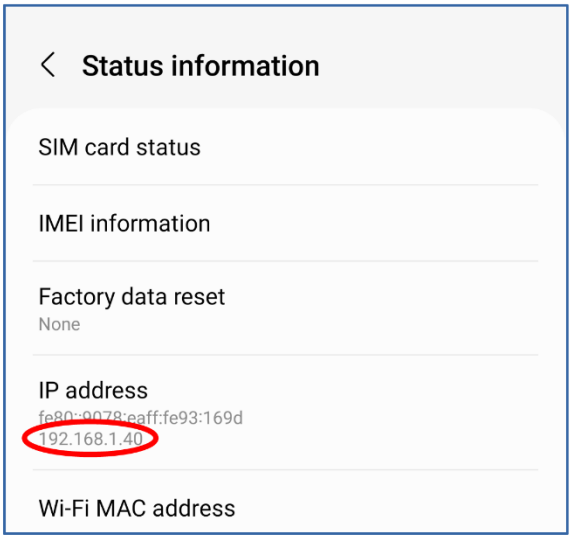

Illustration 2

How to see your device IP address

Android 12: Open the **Settings app**, choose **About Phone**, and then choose **Status Information**. Look under the heading **IP address**. You can see an example of that screen captured on a Samsung Galaxy S10 in **illustration 2**, (above right) with the **IP address** circled.

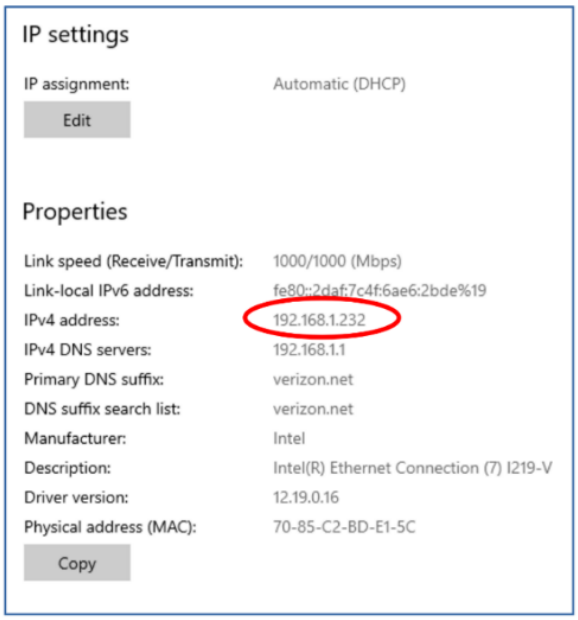

Illustration 3

iOS 15 (Apple): Open the Settings app, and choose Wi-Fi. Just below the Wi-Fi switch, you will see your Wi-Fi network name, with some gadgets to the right. Tap the **info** button (it's a lower case "**i**" inside a circle) to the right of the name of your Wi-Fi network. A new screen appears. Scroll down and find the **IPv4 address heading**. Below that, you will see both your device's **IP address** and the internal **IP address** of your router. See the example to the right (**illustration 3**) with the **IP address** circled.

Windows 10: Open the **Settings** application, choose **Network & Internet**, and click the **Properties** button in the *right-hand pane*. A new screen appears; scroll to the bottom and find the **IPv4 DNS Servers.** You can see an example in **illustration 4** (right), the **IP address** is circled. The router's internal **IP address** is immediately below, on the line marked **IPv4 DNS Servers**.

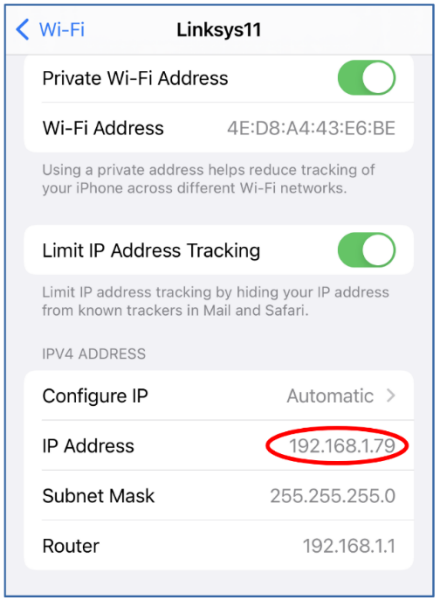

Illustration 4

Port Numbers

As you know from experience, your device can communicate with many other computers simultaneously. For instance, your device can run an email client application, a web browser, and a video streaming application concurrently. Your device uses a second concept called **port numbers** to properly deliver incoming digital info to the correct application on your device.

Ports are analogous to apartments within an apartment building. Each apartment has its number. Physical deliveries are directed to the correct apartment by being labeled with the correct apartment house address and apartment number.

Think of your device's applications as apartments. Each uses a port devoted to the purpose of the application. The ports are numbered, the number range is 0 through 65535, so there are 65,536 ports. Obviously, they are virtual ports, not physical.

Some of the port numbers are, by internet convention, dedicated to specific purposes. Some port numbers are devoted to email, some are for web browsing, etc.

The port numbers in the range of 0 to 1023 are called **well-known port numbers** because those are pre-assigned to specific purposes such as email or web browsing. I reviewed a Wikipedia page listing all of the pre-assigned port numbers; there are many devoted to purposes and applications I have never heard of and many I use every day. Port numbers greater than 1023 can be used for any purpose, and are called **ephemeral ports**.

Some web page addresses include both a name and a port number. You may have accessed a web page expressed like this:

https://www.anyserver.com:8080 (not a real URL)

The number after the colon, 8080, is a port number. It is within the range called ephemeral ports. Using an ephemeral port number as part of the address allows web servers to host many different home pages, and each home page is assigned a different port number.

Your Router

Your router does a lot more than simply send and receive Wi-Fi radio signals. Overall, it serves as the city name in which various apartment buildings exist. The total possible number of **IP addresses** (using IPv4) is close to 4 billion. That sounds like a lot, but, in most metro areas of the world, there are more devices than people, by a large margin.

Long ago, the internet developed a solution. That solution is built into your router, the device that provides your home Wi-Fi.

The router has two responsibilities. First, it assigns **IP addresses** to itself and your devices, in one of two ranges of **reserved IP addresses**, either 192.168.#.# or 10.#.#.#. The router's self-assigned address is called the **internal IP address**. Second, the router acts as your connection to the internet, and as such, the router is assigned an **external IP address** by your internet service provider (ISP), such as Cox, Comcast, Fios, Frontier, etc.

Like a central post office, a router forwards every digital info request from your device to the destination. From the viewpoint of the outside world, the only destination address for responses to your requests is the external **IP address** of the router. When the corresponding digital response arrives at the router, the router forwards the response to your device.

The local address of the router enables your devices to send digital info requests to and through your router because each computer is connected to the router by Wi-Fi or ethernet cable and each smartphone or tablet is connected by Wi-Fi.

What this means in practice is that a large number of routers can assign the same range of **IP addresses** to connected devices. Your neighbor's router can, by chance, assign the same **IP address** to your neighbor's phone that *your* router assigns to *your* phone. The neighbor's router serves a different "city" and has a different external **IP address** than your router has, so servers on the internet can direct responses to the correct router.

My own router's external **IP address**, assigned by my ISP, begins with 96. That is not necessarily a **permanent IP address** assignment. Each assignment of an **IP address** by an ISP to a router has a fixed duration, called a lease. A lease typically expires in 24 hours. Then the lease is renewed by the ISP. However, my router's external **IP address** has not changed in many months. The bottom line: routers and reserved **IP address** ranges make it possible to connect many more than 4 billion devices to the internet, at the "cost" of one **IP address** per router. My router serves 9 or more devices most days and more when I have visitors.

When your smartphone is out of range of your Wi-Fi or is disconnected from your Wi-Fi, then it connects to the cell network or another Wi-Fi if you are in

range. At that point, the **IP address** of your phone is assigned by the network to which it has connected, and is not necessarily the same **IP address** your device was assigned on your Wi-Fi.

For example, on my Wi-Fi, on the day I wrote this article, the **IP address** assigned to my smartphone by my router was 192.168.1.40. When I disconnected my smartphone from my Wi-Fi at home, the **IP address** assigned to my smartphone by the cell network was **100.87.129.39**. Effectively I have moved my smartphone to a different "city".

How can you receive email when your device's **IP address** changes? Your device sends your email account name and password to the email server when you use an email application or a web page to check for email. The current **IP address** is simply the address to which the email server must send its response.

###

Describing the Quantity of Computer Storage

By Joel Ewing, President, Bella Vista Computer Club
June 2021 issue, *Bits & Bytes*
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Computers can store data or information in several ways internally and on various media and storage devices. How we describe the capacity of this storage has evolved considerably over the last 70 years, which explains some of the inconsistencies found in usage.

One of the things one used to be taught in physics, even in high school, was that a number representing a measurement was useless (and counted as an incorrect answer) if not accompanied by the appropriate unit of measure. The unit of measure (g, kg, lb, nt, W, ft, m, km, etc.) was essential to define not only the true magnitude of the value but to distinguish among types of measure: weight, mass, force, energy, distance, charge, temperature, etc.

How We Got Ambiguous Computer Storage Notation

While all computers in common use today tend to have storage organized around the concept of a "byte" or "character" containing 8 "bits" (base-2 binary digits), this was not always the case. Earlier computers had organizations based on decimal digits, on characters represented by less than 8 bits, on

"words" containing some number of decimal digits (10), or on "words" containing some number of bits (12, 16, 32, 36, 48, 60).

For computers organized around decimal digits with memory locations addressed in decimal, one talked about memory having so many "K" digits or words of memory, where "K" was "1000" (no computers had enough memory yet for "M" to be an issue). If varying amounts of memory could be purchased, the physical memory sizes had to be manufactured in quantities that were round numbers in base-10. Machines with 20,000, 40,000, or 60,000 digit memory were described as 20K, 40K, or 60K machines.

Computers that were not organized around decimal digits addressed internal memory locations using a binary address[1], and this required that memory be manufactured in quantities that were round numbers in base-2. So you would have memory size increments of 1024 (2^{10}), 2048 (2×2^{10}), 4096 (4×2^{10}), 8192 (8×2^{10}), 16384 (16×2^{10}), etc.

Those that worked with such computers quickly tired of describing computer memory capacity in the cumbersome exact-decimal-value notation and adapted the shortcut of using K=1024= 2^{10} so the above round numbers in binary could be expressed more simply as 1K, 2K, 4K, 8K, 16K. This was particularly convenient since even if your mind subconsciously saw these values "in decimal," you would only be off by 2.4%. Note that although this is a convenient notation, it is a "corrupted" usage of "K," which is a prefix derived from the Greek word for 'thousand' i.e., 'Kilo'".

Computer storage other than central internal storage was a different matter. Disk storage and tape storage capacities were based on state-of-the-art recording techniques, choice of physical media dimensions, and recording densities. These factors produced capacities that tended to not be nice round numbers in either binary or decimal. Changing the definition of "K" in this context provided no notational simplification, so in the context of disk and tape capacity, "K" continued to have its customary meaning of "1000".

---

[1]An exception were some ingenious machines created at Moscow State University starting in 1958 ("Setun" and "Setun 70") based on the ternary (base-3) number system rather than binary. The ternary design required fewer discrete electronic components, a distinct advantage because of electronic component scarcities in the Soviet Union at that time. Soviet internal politics and software compatibility issues with the more-widely-adopted binary architectures caused the eventual demise of this architecture.

As maximum available and affordable computer storage capacities increased, the above conventions were extended to include the prefixes of

- M (mega), meaning 10^6 = 1,000,000 ***or*** 2^{20} = 1,048,576, depending on context
- G (giga), meaning 10^9 = 1,000,000,000 ***or*** 2^{30} = 1,073,741,824, depending on context
- T (tera), meaning 10^{12} = 1,000,000,000,000 ***or*** 2^{40}, depending on context.
- and so on, for prefixes for powers of 10^3 higher than 10^{12}.

Until the mid-1980s, the only people exposed to these prefix uses were the relatively small number of computer professionals who understood the conventions. The vast number of PCs and other computer devices that have become available over the last three decades have resulted in many computer users now being exposed to these conventions without the underlying knowledge of computer architecture to understand the context distinctions.

The Solution

To eliminate this decimal/binary ambiguity, in December 1998, the International Electrotechnical Commission (IEC) approved an International Standard for names and symbols used as prefixes when applied to binary multiples as found in the fields of prefixes for binary multiples used in the fields of data processing and data transmission. That standard is recognized by NIST (US National Institute of Standards and Technology – formerly known as the US Bureau of Standards) and can be found at https://physics.nist.gov/cuu/Units/binary.html.

By this standard, usages of prefixes K, M, G, and T where a power of 2^{10} is intended should be replaced by Ki, Mi, Gi, and Ti, respectively. These abbreviations correspond to **ki**lo **bi**nary, **me**ga **bi**nary, **gi**ga **bi**nary, and **te**ra **bi**nary, and are pronounced as "kibi," "mebi," "gibi," and "tebi." So, 16 GB of RAM for a PC should more correctly be called 16 *GiB* of RAM. This would be spoken as "16 gibibytes" and mean 16 x 2^{30} Bytes.

Getting people to adopt the newer non-ambiguous conventions has been a non-trivial exercise. After two decades, retail consumer hardware manufacturers are still frequently not observing it. You will find some computer software correctly using the new standards (system and file utilities in Linux), and some not (system and file utilities in Windows 10, which tends to report both

RAM storage and Disk storage in "*GiB*," with both mislabeled as "GB"). That consumers are confused is evident when you see someone who erroneously believes that "GB" always means 2^{30} for computers, or is just confused by Windows 10 misuse of "GB", and complains that the capacity of their hard drive was exaggerated because they misinterpreted the manufacturer's 500 GB to mean 500 *GiB*. I try to use the standard binary prefixes consistently where appropriate, both to avoid unnecessary ambiguity and to educate others about their existence.

If you are familiar with the conventions, it is clear when a retail PC seller advertises RAM of "8 GB" that what they mean is "8 GiB" because PCs use a computer architecture with binary memory addressing. It is similarly clear that a mechanical SATA hard drive advertising 1 TB of storage probably means it approximates, hopefully, a little over 1TB, and not 1 TiB, which would be 10% larger. Close but not exact because there is no reason why a physical device with varying physical track lengths should hit a capacity with a nice round decimal number.

Now in the case of a "240 GB" SSD solid-state drive, I am not certain what value is intended. Since there is discrete solid-state memory under the covers, no doubt the base storage inside the unit is 256 GiB. But there also has to be a programmed computer processor inside that is emulating a SATA hard drive. Out of that 256 GiB, some memory must be used for the hard drive controller program, some space taken for buffers, and other data storage required for the hard drive emulation. Perhaps some space is kept in reserve just in case marginal performance or failures are detected in some blocks of the memory, like having hidden alternate tracks on a mechanical hard drive that can transparently replace a failed physical track. After deducting the overhead for the device emulation, that could leave either 240 GB or 240 GiB usable storage for the emulated hard drive. I suspect they would mean the lower 240 GB in keeping with mechanical hard drive capacity conventions, but it is quite unclear.

It ought to be possible to get RAM and PC manufacturers to use the more correct GiB in place of GB for RAM capacity. Hard drive and SSD manufacturers should specify their approximate capacity in both GB and GiB as well as the actual exact bytes. While the current GB values are conventional usage, you still have the problem with neophytes seeing only a GB value and thinking it should be interpreted as GiB.

Another sloppy usage that drives me to distraction is hearing or reading someone describing his computer storage or speed as so many "gigs." So, he has "billions." Billions of WHAT? "G" is only a quantity multiplier, not a unit of measure! Without the correct units, the number is meaningless. This misuse is particularly confusing in the area of data transmission speeds, where units of both "*bits* per second" and "*bytes* per second" are in common use.

###

Windows free Paint App—Overview

By Jim Cerny, Forums Coordinator / Instructor, Sarasota Technology Users Group www.thestug.org vp1 (at) thestug.org

The **PAINT** app (program) comes free with all editions of Windows. It comes with many options for you to create your drawings or images and modify others. I would encourage you to explore **Paint.** You will find it very useful if you take the time to try it! Here is a quick overview of what **Paint** can do.

If you do not have an icon on your Windows desktop for **Paint** (and I think you should), you can open the app anytime by clicking on the "Windows" icon on the extreme bottom-left of your screen. This will bring up an alphabetical list of all your apps in the left column. Scroll down (the scrollbar for this list may be challenging to see or find – a curse on the designers who hide stuff – it is ***very*** narrow at the top of the list, on the right edge of the list (not the window, just the list column). If your mouse finds it, it should widen to a normal scrollbar width that you can see and use. (They certainly didn't ask me when they designed this!) Scroll down until you see "Windows Accessories" and click on the down arrow just to the right to open the contents of this folder. Next, you should see "**Paint**" and click on it to open it. (Note this is ***not*** "Paint 3D"). You can find out everything about **Paint** by asking Google and viewing some good videos about using it. But here is a quick picture of its features.

You can open almost any image (photo, drawing, clipart, etc.) in **Paint** (using the "File" tab/menu). The file types that **Paint** can work with are BMP, JPEG, GIF, PNG, and single-page TIFF formats. Now you are free to play with that image any way you want. You can draw on it, add text or shapes, crop the image, and much more. You can also *save* the image (use the "Save as" option), and you can save your image as a different file type.

Have you a desire to be an artist? On the "Home" tab/menu, you can use **Paint** to draw and create your images. Select your color or pick your color from a palette, pick a drawing tool (pen, brush, marker, etc.), the size or width of your line, and draw away. There are many useful shapes as well, such as ovals, boxes, arrows, and more. You can even zoom in as close as you wish to see and work with each pixel if you want. That is about as detailed as you can get. Remember, zooming in or out on an image does not change the image size, it just lets you view the image closer or farther away. If you make a mistake, the "undo" arrow at the top will erase the last thing you did. (ED: so will CTRL+Z.)
You can resize an image (to save memory size), rotate the image, erase things in the image, or select some part of the image for some action, such as copying or deleting. Yes, you can add text in a "box" or right on the image.

Has **Paint** now sparked some interest? Please use Google to ask about how to use **Paint** and explore its many options. It is a very fun tool, easy to use, and will boost your creativity too! No real paint, no canvas, and no mess!

###

Adventures with Apple and AppleCare Support

By Gabe Goldberg, APCUG Advisor, Region 2
APCUG Rep, PATACS & WAP Gabe (at) gabegold.com

Having collected several Apple devices—my and wife's iPhones/iPads, my Apple Watch, three HomePod Minis—plus six outlets controlled by the Home app—I've also collected a (very) few gripes, frustrations, irritations, and wishes:

- After the most recent Watch/iPhone software updates, very simple automation stopped working.

- Grouped notifications no longer indicate how many are stacked.

- The Zoom app didn't update on the iPad with other apps; it had to be done manually.

- Siri Intercom messages only play on HomePods; not on iOS/iPadOS devices as I'd expected.

I finally called Apple to address at least the most annoying first two problems, especially the failed automation.

After negotiating the obligatory (but not ghastly) phone robot, I reached a very pleasant woman who quite thoroughly researched the automation problem—putting me on hold for a bit, returning and apologizing for the hold, and researching more. She finally said she'd have to escalate to Level 2.

In the process of doing that, I was disconnected. I sighed, not wanting to repeat the entire process. Then my phone rang, and I was called back and connected to the same person. That's NEVER happened when talking to customer support and disconnected—it's ALWAYS involved calling again and starting from scratch.

I was then connected to John, "Senior Advisor" or some such title. He was great; he understood the problem, reviewed steps I'd taken to research/resolve it, and said I needn't repeat them (again, contrasted with most customer support, which follows rigid scripts and insists that steps be followed for them even if they've already been done).

When I mentioned that a local Apple employee had replicated the problem (likely with a newer iPhone than mine), he agreed that probably meant the problem wasn't specific to my hardware/software. He spent quite a while documenting the problem, during which he put me on hold and apologized for the wait; I joked that he might be writing a book about the problem and said I was keeping busy on my computer while waiting. I said that I hoped he wouldn't hold it against me because I was using a Windows PC; he laughed and said he had one too.

He sent me an email giving his contact information and a link to upload a screenshot of the failure message on my Watch when he finished. Finally, he

said he'd take ownership of the problem and made an appointment to call back with updates from engineering.

He called back on the designated day and apologized for being nearly an hour late. I laughed and said that he was so far ahead of support from that other technology company (whose name starts with "M") that I hadn't noticed. He said the problem was understood and would be fixed in an upcoming operating system update—either the next or the one after that. It wasn't fixed in one just installed—there likely wasn't time for it to get in that one—so I assume it will be along shortly.

So that's more strong contrast with other tech support experiences—individual problem ownership, contact information provided without being requested, and definite checkpoint provided.

While it's not clear where the problem was, the Zoom app now appears to be updating automatically on the iPad, simultaneously with the other apps.

Despite my product(s) being out of warranty coverage, Apple provided complimentary phone support. This support is available for questions, and product problems after the warranty and AppleCare (if purchased) have expired.

###

Editor's notes and comments:

1. In John Krout's article, he mentions the old IP address standard, **IPv4**. It is known as "the dotted quad" (###.###.###.###), where each number can be between 0 and 255. The problem? No more addresses are available…we've run out! To get around that *minor* problem, a new format has been released: IPv6. For more info check out this article: https://www.wikiwand.com/en/IPv6

2. It continues to amaze me that people still think that Google is the only search engine and they continue to recommend it. It's not. If you like being spied on and having your data harvested and sold when you are searching for something, then, by all means, continue to use it. IF YOU DON'T like it (and I sure don't), then use a search engine like **DuckDuckGo** (DuckDuckGo.com) to privatize your searches. DDG doesn't spy on you—it's as simple as that. If DDG is not your default search engine find the instructions for your browser of choice online and change it. And yes, you can change the search engine in the Chrome browser (made by Alphabet/*Google*).

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1st Wednesday	7:00 – 9 PM	Arlington General Meeting	Hybrid
3rd Monday	7:00 – 9 PM	Board of Directors Meeting	Zoom
3rd Saturday	12:45 – 3:30 PM	Fairfax General Meeting	Hybrid
4th Wednesday	7:00 – 9 PM	Technology & PC Help Desk	Hybrid

Meetings are Hybrid or Zoom (as above)
To attend in person you must meet the requirements. See patacs.org.
Online Meeting Access Will Be Sent Via Email

PATACS Event Information
Messages may be left at 703-370-7649
Website: **https://www.patacs.org**

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