The Databus

Monthly Newsletter of The Dayton Microcomputer Association
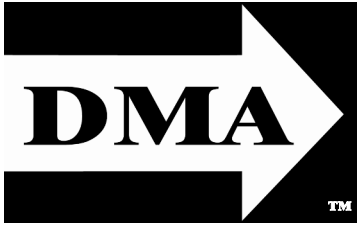
—Contents—

Volume IX (New Series)
number 11
november 2019

DMA Holiday Banquet!
7:00 P.M. (6, Meet & Greet), Wednesday, 4 December, on the (heated) patio, at T.J. Chump's
Tickets: $5.00 (cheap)

ESTABLISHED IN 1976, DMA is a group of Dayton-area professionals and enthusiasts in the field of computing and digital information technology. General Membership Meetings are usually held on the last Tuesday of each month. DMA has a number of Special Interest Groups (SIGs) in areas ranging from digital investing and genealogy to the Linux operating system. Each SIG meets according to its own schedule. DMA is a member of the Association of Personal Computer Users' Groups (APCUG) and the Affiliated Societies' Council (ASC). Click on any of the logos—including our own (top left)—to go to that organization's Web site.

Submissions ...

THE DATABUS welcomes compliments, complaints, suggestions, and especially articles. We can accept articles in ASCII, or as attachments in Microsoft Word, Open or Libre Office Writer, or, yes, even WordStar (a word-processing program that goes all the way back to about 1980!). No PDF files, please. Send articles to:

Editor@DMA1.org

All articles are subject to editing for spelling, grammar, usage, and space. Always retain a copy of your work, as THE DATABUS cannot be responsible for loss. When articles are of roughly equal quality and importance, those by paid-up DMA members receive preference.

ALL REGISTERED TRADEMARKS, for example: the DMA Arrow, Linux, Nord VPN, or Verisign, are the property of their respective owners. However, the Registered Trade Mark symbols (® or ™) have been omitted for better readability. The Editor occasionally inserts comments into articles. Such comments are sometimes preceded by the phrase: "EDITOR'S NOTE," are usually in square brackets [like these], and are always in sans-serif type.

The DATABUS is written and published by volunteers. We do not give professional advice on hardware, software, or network installation, repair, security, or troubleshooting. If you need expert assistance for your digital device, please seek the advice or services of a competent, certified professional.

November Meeting: 7:00 P.M., Tuesday, the 26ᵗʰ, at T. J. Chump's, 7050 Executive Boulevard, Huber Heights 45424 (next door to Meijer's — click *here* for a map). Come at 6:00 P.M. if you want to join us for dinner. There's plenty of free parking. (Chump's restaurant is also accessible via RTA bus routes #18 & 19, but you must take a short walk from the Meijer's supermarket parking lot.)

Free parking—No charge—bring a friend!

November Meeting—
ED DAVIDSON: *Scanners*

NO, NOT THE 1981 HORROR MOVIE—we're talking about devices that convert documents or pictures into computer images!

Paper records have become the bane of today's society. We have too many of them in our offices, and worse, at our residences. The law obliges us to keep many of them for years—at times, *forever,* as in the case of income tax files. And there are all of those photographs, their color fading over the years until they're washed-out ghosts of the originals. Photos are Ed's specialty, and he'll have tips on such things as restoring faded snapshots.

Are scanners the answer? And if so, what to buy? "All-in-one" printers scan as well as print, but this writer can testify that while they produce high-quality images, they are slow and can generally only take letter or legal size (or smaller) sheets.

And what software is best for scanners? What definitions to use? 300 dpi (dots per inch) is the default on most scanners. But professional archivists recommend 600 dpi as a *minimum* for archival (library) use — 800 dpi is preferred. Even higher definitions are suggested for photographs, drawings, and other graphics.

Join us for an enlightening evening with DMA Trustee EDWIN DAVIDSON on Tuesday, 26 November, at our usual time and place: 7 P.M. at T.J. Chump's Restaurant in Huber Heights. Click on the Web site below for more information:

https://www.meetup.com/Dayton-Microcomputer-Association-Meetup/events/   **... TDB**

Minutes are normally published almost two months late, because the Minutes for, say, the October Board meeting must be approved by the Trustees at the *following month's* meeting—in this case, early November. The corrected and approved October Minutes would thus usually appear in the November DATABUS (this issue), published toward the end of that month.

Trustees' meetings are on the *first Monday of each month,* except when that day is an official holiday, begin at 7 P.M., and are open to all DMA members. See the end of the Minutes (page 6) for the location of December's meeting. Trustees have recently had "bring your own sandwich or fast food" meetings. Those wishing to dine with the Trustees should come about 6:30, and, of course, bring their own food and <u>nonalcoholic</u> drinks.

MINUTES—DMA BOARD OF TRUSTEES
Meeting of Monday, October 7, 2019

CALL TO ORDER

The meeting was called to order at 7:10 P.M. by Peter Hess.

Trustees present: Martin Arbagi, Glady Campion, Edwin Davidson, Pat Flynn, Peter Hess, Gary Turner. **Excused:** Debra McFall. **Absent:** Brent Kerlin. **Guests:** Mark Camden, Lillian Rudolph, Ken Phelps.

OFFICERS' REPORTS

President — Peter Hess

Last month's meeting with "Geeks on Tour" was well received. The Gulds shared plenty of good advice, more than enough for everyone to have learned something. People stayed late to talk with the speakers. The Gulds would like to hear feedback on their website.

Vice President — OPEN!!!

Dayton Diode plans to hold a "re-boot" meeting later this month.

Dayton Oracle is struggling to restart. Dan Boylin has been trying to connect with a local Oracle user group liaison, but is having trouble getting a response.

Secretary — Glady Campion

Glady presented minutes for August and September board meetings. **Martin Arbagi moved they both be accepted as corrected. Pat Flynn seconded and the motion passed with Glady and Edwin abstaining.**

Treasurer — Pat Flynn

Pat e-mailed the Treasurer's report: *(right)*

COMMITTEE REPORTS

Audit — Glady Campion

In progress.

Fund Raising — Peter Hess

Peter is looking for another retail store like Kroger and Dorothy Lane that will allow customers to direct a percentage of

ACCOUNT BALANCES:	
Fifth Third Checking	$9,261.82
Fifth Third Savings	8,248.78
Pay Pal	169.03
TIAA CD	5,287.67
Wright-Patterson Credit Union Savings ("Share")	5.00
WPCU Checking	1,000.30
WPCU Money Market	4,034.90
Dayton Foundation	+91,772.98
Total	**$119,780.38**

(OCTOBER MINUTES—Continued from page 4)

sales to DMA.

Marketing — Gary Coy, Pat Flynn, Peter Hess, Debra McFall

Peter has been contacting senior centers, inviting their members to our meetings. Transportation may be a problem in some cases. Senior centers such as Lincoln Park are very interested in having our members go to their facilities to teach.

Edwin talked about the possibilities of "repair parties" at local restaurants.

Membership — Glady Campion

As of last month's General Membership meeting, we had 52 Regular, 3 Associate, 0 Student, and 5 Life members for a total of 60. Attendance was 34 and the 50/50 raffle brought in $30.

Net Administration Team — Ken Phelps, Gary Turner, Pat Flynn, Brent Kerlin

No problems with the Web site to report. Mark Camden is maintaining the dma1.org Web site.

Programs — OPEN!!! We *must* find a Programs chairman!!!

Thank you to Peter Hess for conducting the DMA Annual meeting and to Chris and Jim Guld for a very informative and entertaining presentation.

October – David Howard will talk on Cybersecurity

Other suggested topics: Streaming video, Car hacking, Chromebooks, Bitcoin and Block chain, InitiativeQ.com, Internet Architecture; Smart Home technologies;

Gary Turner suggested that we advertise for new speakers on the Web site or in the newsletter.

Pat Flynn moved to reimburse Peter Hess for meals for the speakers for August and September. Martin Arbagi seconded and the motion passed.

Publications — Martin Arbagi

THE DATABUS for October is in the works.

UNFINISHED BUSINESS

Wright State Archives – Martin Arbagi, Glady Campion

Still in progress.

Next Board Meeting

The next Board Meeting will be 7 P.M. on Monday, November 4, 2019 at **Fairborn Fire Station #2,** 2200 Commerce Center, Fairborn. Those who want to join us for dinner should meet between 6:00 and 6:30 P.M. at the Fire Station. Bring your own food and nonalcoholic beverages.

The Fairborn Fire Station #2 has been reserved through December 2019.

Summer Picnic — Martin Arbagi

Glady presented the final report for the picnic.

Edwin Davidson moved that Glady be reimbursed $114.50 for the picnic expenses. Pat Flynn seconded and the motion passed with Glady and Martin abstaining.

Community Service

One donation was sent in, the other is in the works.

Holiday Dinner — Glady Campion

The dinner will be 7 P.M. (6 P.M., "Meet & Greet") on Wednesday, December 4, on the

(OCTOBER MINUTES—Continued from page 5)

(heated) Patio at T.J. Chumps. Tickets, $5, are available for sale.

Make It Dayton Festival — Glady Campion

The event was Saturday, October 5th at Carillon Park. DMA, Dynamic Languages, and Linux all had displays in the main hall. Stephen Frey completed the square with a display for his Inventors' Council of Dayton. We had a steady stream of visitors, many stopping to talk and asking for information on DMA.

NEW BUSINESS

Appointment of Trustees

Glady moved that Ken Phelps be appointed to the board to fill the open Trustee position, a term that runs through September 2021. Martin Arbagi seconded, and the motion passed.

Election of Officers

Edwin Davidson moved to accept these nominations. Martin Arbagi seconded and the motion passed.
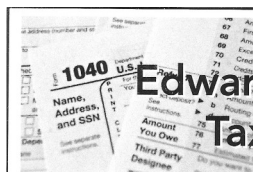
President:	Peter Hess
Vice President:	Ken Phelps
Secretary:	Glady Campion
Treasurer:	Pat Flynn

VOLUNTEER OF THE MONTH/QUARTER/YEAR

Mark Camden and Glady Campion were nominated for Volunteer of the Quarter for their collaboration on the new design of the DMA1.org Web site.

The meeting concluded at 9:30

Respectfully Submitted,

Glady Campion, Secretary

My Experience with a Subscriber VPN: Advantages, Costs, Pitfalls, Workarounds

PART 1 OF A TWO-PART SERIES

By John KROUT, Member, Potomac Area Technology and Computer Society (PATACS)

www.patacs.org

jkrout75 (at) yahoo.com

THIS ARTICLE IS BASED ON A LOT OF RESEARCH, several years of use of a corporate VPN at work, and a few months of using a subscriber VPN at home.

VPN is an acronym for *Virtual Private Network*. The idea is that your use of a VPN provides a secure method of data communication, through strong encryption. The encryption hides the information in your communication, such as content of e-mails and URLs of Web sites, from your Internet Service Provider (ISP) and any other "Man in the Middle."

WHY VPNS EXIST

That phrase *Man in the Middle* is important. Your communication with your e-mail server or any Web site may pass through half a dozen or more servers in between. For any one of those intermediate servers, any bored or underpaid system administrator, and any hacker breaking in, might install message trapping software to capture data passing through, such as your IDs and passwords for your stockbroker or bank. Those snooping activities are called "Man in the Middle Attacks." Encryption makes it almost impossible for them to make use of that information.

Originally, when local area networks (LANs) first became available, the only networks were inside a single building where all the computers were connected to the local network, with no connection to anything outside the building.

Later, secure direct circuits, modems, and eventually the Internet, allowed communication among computers on the inside and the outside.

A very entertaining book, *The Cuckoo's Egg*, written by Clifford Stoll, describes the Bad Old Days before VPNs, when networks were insecure. It is a fascinating read. The author, an astronomer, was given the task of tracking down a 75¢ discrepancy in billing for use of a university local area network. His investigation led him to identify people who broke into the network. He found the same people also broke into military computers. He tracked them to Europe, where they were tried and convicted based on his testimony and a huge pile of printed computer logs as physical documentary evidence. Stoll was a *good* "man in the middle!"

Because of experiences like that, corporations and the federal government have used their own VPNs for many years. VPNs have enabled greater automated data movement, ensuring privacy of the data due to the use of strong encryption.

And, now, VPNs are available to the rest of us.

While using a VPN, the encryption is based on two *digital certificates*. The VPN server provides one to your computer, tablet, and smart phone. Additionally, the VPN server itself has another one. The encryption using those two certificates is based on some very creative research done in the early 1980s by three MIT professors, Rivest, Shamir, and Adelman, who founded RSA and Verisign, two companies now at the heart of modern digital security efforts.

A second result of the two-certificate approach is that your account is known to be valid by the VPN server, and the VPN server is known to you to be valid as well.

Without using a VPN, Web sites and other Internet services get access to the Internet protocol address (IP address) of your home router, computer, phone or tablet. This is important because those IP addresses let Web sites figure out where you are located. When you use a VPN, the Web sites see only the IP address of the VPN server. In this way, a VPN server acts as your proxy, and are sometimes called **proxy servers**.

Take a look at **Illustration 1.** This shows how a VPN server fits in the overall path of servers between your computer, phone or tablet and the world of the Internet. Inevitably, your VPN-

How you connect to the world through a VPN

Your computer or tablet or phone   ISP servers   VPN server   Destination servers

VPN Encrypted communications   VPN Encrypted communications   Unencrypted communications "in the clear"
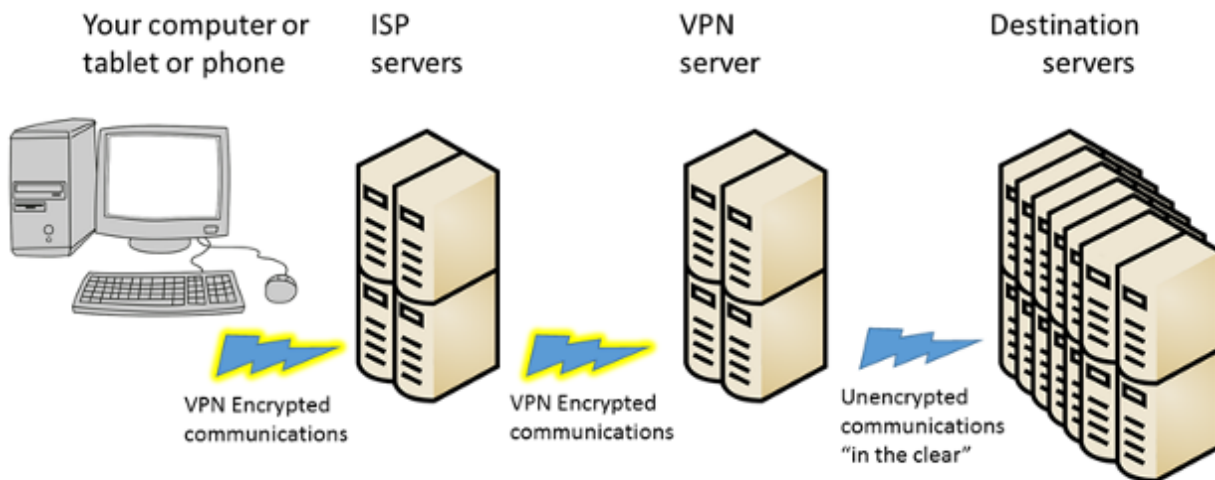
Illustration 1.

encrypted communications pass through your ISP servers, and then possibly through other intermediary servers until it reaches the VPN server. Using a VPN server severely limits any snooping not only by your ISP but also by any servers between the ISP servers and your VPN server. So the

The Man in the Middle is stymied in that part of the path.

Beyond the VPN server, the communication is unencrypted by the VPN, or *in the clear*, and at that point reaches the destination, which might be for instance a video streaming server, or a credit card company's Web server. Of course, that leg of the path also involves intermediate servers.

(VIRTUAL PRIVATE NETWORKS—Continued from page 8)

Because that leg of the overall communications path is not depicted as encrypted, you might think that a Man in the Middle Attack would succeed there.

However, these days most of those destination servers use HTTP-Secure protocol (https), which also employs encryption done in a different way, by your Web browser and by the destination server. That's right: a *second* encryption. As a result, the communication remains secure all the way through the entire path.

But I want to digress for a moment and suggest that your ISP might also behave as a Man in the Middle.

When you use a VPN, the fact that the servers of your ISP see only encrypted data is very significant. Your ISP is always in the best position to snoop, effectively a Man in the Middle for all the Web sites you browse, the streaming services you use, and so forth. All of your browsing and other use of the Internet goes through those ISP servers.

Your ISP has a strong economic incentive to take advantage of that best position: data on the Web sites you visit and the downloads you select can be quite valuable to third parties. And don't think ISPs will ignore that incentive simply because you are a customer of the ISP; the big ISPs convinced the FCC to eliminate Net Neutrality rules so that the ISPs could solicit money from the likes of Netflix and CNN to accelerate delivery of those sites to your computer.

So use of a VPN consistently protects you from snooping by your ISP.

MORE ADVANTAGES OF A VPN

I have been using a VPN and HTTPS from my work site for more than a decade. I have seen no significant impact on communication speed. Computers do the encryption and decryption quite quickly these days.

An advantage of subscriber VPN services is that you have access to hundreds or thousands of VPN servers, in many cases spread around the world. If one is busy or down, you can easily use another. Redundancy is a very valuable advantage.

Another advantage is that you can choose a VPN server located in a country where a local Web site or video streaming service is of interest to you. For instance, the BBC streaming service is open only to users located in the UK. When the BBC servers detect a request from a US IP address, the servers ignore it. if you use a VPN Proxy server in the UK, the UK IP address of the VPN Proxy server tells the BBC that you are local, and you then get to use that streaming service.

(VIRTUAL PRIVATE NETWORKS—Continued from page 9)

A third advantage is far less clear. According to *PC* Magazine, many VPN users in the US subscribe specifically because the federal government has eliminated the Net Neutrality rules. The idea is the ISP cannot throttle back what it cannot decrypt, meaning what it cannot recognize. NordVPN, for one example, actively promotes that idea on its company's Web site.

I am not convinced that idea is correct.

COUNT YOUR VPN-READY DEVICES

Another advantage is that subscriber VPN services let you connect more than one of your devices (computer, phone, tablet) to the VPN *at the same time*. This is important if you use two or more Internet-connected devices, as I do. And it is a major convenience factor, allowing you to leave all your devices connected all the time, not just when you actively use each one.
Snoopers can monitor the Web browser on your phone or tablet just as readily as they can on your computer. A VPN can and should protect all of those devices.

Several VPN services that I reviewed set a ceiling on the number of concurrent uses by a single account, and that limit varies from three to ten. Because of that, before you select a VPN service, you need to make a realistic assessment of the number of concurrent connections you may need.
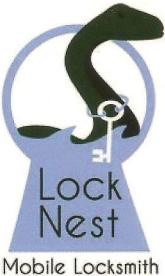
For example, in my case: I have two Windows computers, two Android tablets, and one Android smart phone, a total of five devices. My son has a Windows computer, a Linux computer, one Android tablet, and one Android smart phone, a total of four devices.

So our grand total is nine.

COMPARISON SHOPPING FOR VPNS

When I was shopping for a VPN service, I came across a review of public subscriber VPNs on

Have a business card? Are you a DMA member?

Any paid–up member of the Dayton Microcomputer Association is entitled to a *free* business card–sized advertisement in The Databus. Send a good–quality image (preferably 600 dpi or better) to Editor@DMA1.org, or give your business card to **Martin Arbagi,** the Editor, at any DMA meeting. We can embed a link to your Web site (if you have one) in the image of your card. Under weird IRS regulations, your Web site may not include discount coupons for DMA members, although discount offers may be included in the advertisement *itself.* See the example just above, which includes a member discount. But the advertiser (Steve Davis) could not have posted that discount on his Web site. It appears *only* in The Databus.

(VIRTUAL PRIVATE NETWORKS—Continued from page 10)

TechRadar.com, published in March 2019. **Illustration 2** *(next page)* is a table comparing the top three VPN services according to TechRadar's ratings system, and some details about them. The number of servers and countries will likely continue to grow for each of the public subscriber VPNs.

VPN service	# proxy servers	# countries	Ceiling on devices per account
ExpressVPN www.expressvpn.com	3,000	94	3
IPvanish www.ipvanish.com	1,200	60	10
NordVPN www.nordvpn.com	5,300	60	6

Illustration 2.

The column labeled "Ceiling on devices per account" indicates the ceiling on the number of computers, tablets, and smart phones on which you run the VPN client software simultaneously. The column labeled "# proxy servers" is especially valuable for redundancy purposes. If one VPN proxy server happens to be down, or malfunctioning, then you can try many others. Generally, more is better.

Concerning the number of countries, although the overall situation worldwide is improving all the time, to some extent I think there are diminishing returns beyond about fifty countries. This is because smaller countries have fewer localized streaming services, and often do not have high bandwidth connections to the Internet, so VPN servers in many smaller nations cannot work as rapidly as VPN servers in, say, the US, Canada, Australia, Western Europe, Japan, or South Korea.

I chose to subscribe to the **IPvanish VPN service.** Its ceiling on the number of concurrent connections is ten. That was the most important factor for me.

Later on, I found that VPN services are now so popular that *PC* Magazine reviews the services and provides Editor's Choice awards, their long-coveted recommendation. In 2019, the Editor's Choice awards went to three VPN services:

NordVPN (click here),
Private Internet Access (click here),
TunnelBear (click here),

NordVPN was the one service that was top rated by both TechRadar and *PC* Magazine.

PRICING

The VPN services have a monthly rate, usually less than $10, and offer discounts if you pay in

Don't be like Harrington and his goofy friend! Click <u>here</u> for a map to the DMA Holiday Party, 7:00 P.M. (6 P.M., Meet & Greet), Wednesday, 4 December, at the heated patio of T. J. Chump's Restaurant in Huber Heights. (Turn right as you come in the main entrance.) <u>Cash bar, and order from the regular menu.</u> (The $5 admission pays for door prizes. *Everyone* wins at least one prize!)

See **Glady Campion** at Tuesday's meeting for tickets.

About The Dayton Microcomputer Association, Inc. (DMA)

MORE THAN FORTY-THREE YEARS AGO, a small group of computer enthusiasts from the Dayton, Ohio area gathered around a kitchen table looking at, and playing with, a first-generation personal computer called the Altair 8800, which one of them had purchased. This computer had been featured earlier on the cover of the January 1975 issue of *Popular Electronics* magazine. Paul Allen had shown the selfsame article about the Altair to Bill Gates, and later, they wrote software together for that computer. Still later — and still together — Allen and Gates founded the Microsoft Corporation.

Shortly thereafter, those Dayton-area computer enthusiasts joined together with many other like-minded, inquisitive individuals to form the Dayton Microcomputer Association (DMA), now one of the oldest continuously-operating computer user groups in the world. Typically, computer user groups, and the newer iteration, technology user groups, are volunteer-run operations. The DMA is an all-volunteer led, organized and run 501c(3) non-profit organization.

Now, there are hundreds of computer (or technology) user groups in the world — all of which continue to foster improved communication between technological equipment and software manufacturers and publishers — with users of those products. User groups (both computer and technology) provide an environment where more experienced technology users introduce additional and advanced techniques to the less informed.

DMA offers both monthly General Membership Meetings, which cover new and innovative topics including a wide range of generic, technological topics, and its Special Interest Groups (SIGs) which address concerns about specific technology interests. There are eight different SIGs sponsored by the DMA, covering such topics as the Linux operating system, various programming languages such as Python, the use of technology to investigate genealogy, and digital aids to investing. Neither SIG members nor attendees at DMA General Meetings need be members of the parent organization, though they are encouraged to join so DMA can continue providing its services to the public.

Annual dues for DMA membership, which have not been raised for decades, are $25 for Regular Members, and $12.50 for Family/Associate Members (someone living at living at the same address as a Regular Member). Nonvoting Student Memberships are *free* to students through age 22. General Meeting door prizes, and both product and service discounts are available to all DMA members.   **... TDB**

(VIRTUAL PRIVATE NETWORKS—Continued from page 11)

advance for, say, three months or for a year. Some even offer further discounts if you pay in advance for three *years.*

Some VPN services have their business offices outside of the US and may charge your credit card to a bank outside of the US. You may wish to let your credit card company know in advance, so that the charges will not be automatically blocked.

This ends Part 1. In Part 2, you will learn about some difficulties encountered on VPNs, and some workarounds. [EDITOR'S NOTE: Part 2 will appear in the **January** DATABUS.]   **... TDB**

ABOUT THE AUTHOR: *John Krout* is a former President of the Washington Area Computer User Group (WAC), one of two groups that merged to become the Potomac Area Technology and Computer Society (PATACS). He has been writing about personal computer uses since he joined WAC in the early 1980s. He is a frequent contributor to PATACS Posts, and occasionally provides presentations on tech issues at PATACS meetings. He lives in Arlington VA and is a writer for the Thales Group, a major maker of automated fingerprint identification hardware, supporting the use of that hardware in the computer system of a major federal government agency.

DAYTON MICROCOMPUTER ASSOCIATION Membership Form

Today's date _____/_____/_____

☐ **NEW**   Please credit the DMA member who recruited me: _____

☐ **RENEW** Contact information below is new ☐ Y   ☐ N

TYPE OF MEMBERSHIP

☐ *REGULAR*   **TELEPHONE:**

Name _____ Home or Work (_____) _____-_____

E-mail _____@_____•_____ Mobile Phone (_____) _____-_____

☐ **ASSOCIATE** Family or Associate memberships are for a family or other member living at the same address as a Regular Member. Name of Regular Member _____

Name _____ Home or Work (_____) _____-_____

E-mail _____@_____•_____ Mobile Phone (_____) _____-_____

☐ **STUDENT** Free Student non-voting membership is available to those through 22 years of age, enrolled full-time in a program of higher education. Name of School: _____

Name _____Home or Work (____) ____–_____

E-mail _____@_____•_____Mobile Phone (____) ____–_____

Home Address _____

City _____ State _____ Zip _____

INTERCHANGE

Skills & interests you might share with DMA _____

What you hope DMA will provide _____

DUES AND FEES

Regular membership:	$25.00 X ☐ 1yr ☐ 2yr ☐ 3yr	$_____	
Family/Associate membership:	$12.50 X ☐ 1yr ☐ 2yr ☐ 3yr	$_____	**NOTE:** *a $10.00 fee will be charged for any returned checks.*
Student membership:	FREE	$___0.00	
One-time setup fee for Shell account: $10.00		$_____	
Total...…...…...		$_____	

☐ **SHELL ACCOUNT** A shell account on the DMA Web server provides file storage, hosting of a personal non-commercial Web site, @dma1.org e-mail alias (forwarding address), all for a one-time fee of $10. A user name must be 8 alpha characters. The usual default is your last name and first initial, with no caps or punctuation. DMA reserves the right of final decision on all user names: 1st choice _____ 2nd choice _____

Make your check payable to: **The Dayton Microcomputer Association, Inc.**
Mail check and application to: **PO Box 4005, Dayton OH 45401-4005**
Or use Pay Pal to send your payment to: **membership@dma1.org**

DMA use only

Member# _____ Exp ____/_____ [ ] Cash [ ] Check# _____ [ ] Pay Pal Proc by _____

Member# _____ Exp ____/_____ [ ] Cash [ ] Check# _____ [ ] Pay Pal Proc by _____

Member# _____ Exp ____/_____ [ ] Cash [ ] Check# _____ [ ] Pay Pal Proc by _____

Last Revised October 21, 2019 (typography only)